MEDICINE AND MEDICAL PROCESS AS A LEARNING SYSTEM

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A dissertation submitted in fulfilment of the requirements for

the Masters in Philosophy in Systems Management

Programme for Systems Management, School of Engineering Management

University of Cape Town

April1996

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ABSTRACT

Health care systems all over the world are in crisis. The presenting symptom is a cost spiral that is out of control. Money supply is finite, and if this problem continues the system will eventually collapse.

There are a number of causes associated with the problem that are usually analysed by reduction, an approach based upon an assumption of simple linear causal relations. This study shows the problem to be the dialectic opposite, in other words these problems are all interrelated through complex causal interactions. Therefore, the health care system is a complex social system and solutions to its problems may be found in terms of the interactions in such a system.

An investigation into the history of the health care system shows that the system started with a simple one on one interaction between patients and physicians. At the time of its initiation, very little empirical knowledge was available about illness. After the renaissance, this changed dramatically with a subsequent increase in the ability to diagnose, but also in the complexity to treat illness. However, modern beliefs about illness and illness processes do not reflect the complexity of this knowledge.

Beliefs about both illness and knowledge contribute to the process of diagnosis (medical decision making, or problem solving). Furthermore, the expectations, wants, and needs of patients and physicians, as well as the decision environment, increases the complexity and difficulty of this decision making process. These decisions initiate treatment processes that are ultimately represented in the health care system as cost. Therefore, the patient-physician system as the simplest initial interaction is an event that ultimately affects cost. This system is not functioning efficiently at present and a system of inquiry that can improve it may make a contribution to an improved system, and therefore a saving in cost. Altering the diagnostic system from a linear into a circular process, in other words into a learning system, improves both decision making and the use of knowledge. However, an inquiring system is needed in addition that can enhance the rigour of this process.

Charles West Churchman devoted a large part of his[1] work to knowledge and the way we acquire knowledge, in other words inquiring systems. His belief is that problem solving ought to be approached in a comprehensive way in order to minimise the risk for making incorrect decisions. Furthermore, because decisions are made upon incomplete information, the solutions will be the cause of new problems. Therefore, problem solving is a never ending cycle of learning. In order to have as complete information as possible about the problem, we have to: know the history of the problem, take a broad view that includes the environment of the problem (use a systems approach), and consider all the alternative solutions to the problem. Virtually all of our knowledge is based upon underlying assumptions. In order to test the validity of the knowledge we use for inquiry and decision making, it is important to test the assumptions upon which the knowledge is based. This is valid in regard to empirical knowledge as well. Finally, according to Churchman, decision making has to be ethical. Therefore, we have to do all we can to ensure that the implementation of the decision will improve the situation, not only now, but also in the future.

The application of Churchman's approach to the patient-physician interaction, assists in the synthesis of a more comprehensive world view of health care and illness. This study shows

[1] Disclaimer. In this text, words importing the masculine shall include the feminine gender and vice versa, unless such interpretation is inconsistent to the context thereof.

that this leads to important changes in the negative interactions identified as contributing to the health care crisis. In terms of Churchman's approach, the role of physicians can be seen as managers of illness. Their purpose is therefore to plan for the improvement of illness (the problem) in an ethical way. Such planning should include the values of patients in deciding upon appropriate treatment.

It is the submission of this study that only a methodology that is able to address complex human systems, such as a systems approach, and a comprehensive philosophy of inquiry, such as that of C West Churchman is appropriate to address the current problems of the health care system.

STRUCTURE AND ARGUMENT OF THE STUDY

Many complex systems including social systems have a tendency to decay into chaos[2]. This is balanced by processes that attempt to create order[3]. Processes of life as we know it therefore take place on the edge of chaos (Waldrop, 1992:12). Furthermore, these systems are composed of many parts that interact with each other in many ways. This means that they are changing all the time in unpredictable ways.

In order to survive in such an uncertain and constantly changing environment, we have to observe events in the environment and save our experiences in memory, in other words, we must be able to learn (*gain knowledge by experience* (Allen, 1992)). These experiences are images of life as we have experienced or perceived them[4]. They are useful for avoiding previous mistakes or re-enacting past successes when situations similar to those experienced in the past are encountered. Our survival (and the survival of complex systems) therefore depends on the ability to adapt and learn.

The fundamental difference between humans and other animals is the fact that we are conscious[5] of both ourselves as individuals and our environment. Decisions made in response to a changing environment are usually made in an intuitive[6] way. However, because of our awareness[7] we are able to use reason to make better decisions. Reason is a powerful tool when it is used for testing the underlying assumptions upon which our decision making is actually based. We can therefore use reason to inquire into the processes by which we make decisions and through a process of inquiry can learn about the way that we arrive at our decisions. In this way, we can learn to make better decisions.

The use of reason and argument in seeking truth and knowledge of reality are activities associated with philosophy (Allen, 1992)[8]. There are different schools of philosophy that use reason in different ways to seek knowledge. None of these schools can claim to have the perfect method of reasoning (Johnstone, 1965:96). However, to reason and inquire logically, basic assumptions have to be made. One or a combination of the philosophical methods therefore have to be followed by necessity in any process of reasoning. McKeon (Quoted in (Johnstone, 1965:93)) uses a classification of three different approaches to philosophy. (This classification is similar to that of Churchman's, which will be discussed in chapter 5).

i. Dialectic methods (Plato, Hegel, Marx). These schools use an approach of proof and inquiry with the object of removing contradictions. They construct the sciences into a unified whole in which all forms of knowledge are arranged in a hierarchy.

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[2] Second law of thermodynamics: *any system left to itself tends toward a state of greatest disorder* (Bowler, 1981:11). This is associated with entropy, which is a measurement of the degree of disorder (Allen, 1992; Checkland, 1991:94), or the degree to which the energy of a system is no longer usable (Bowler, 1981:10).

[3] Negentropy is the building up of systems containing energy (Bowler, 1981:10).

[4] In this text the term images will be used after Boulding (Boulding, 1987). The term mental models is preferred by some systems practitioners and when used in this text, will by implication mean images.

[5] Consciousness in this text is understood to mean: *a state of awareness including both apperception (perception modified by one's own emotions and thoughts) and sensorium (state of functioning of the special senses)*(Kaplan and Sadock, 1991b:214).

[6] Intuitive: *immediate apprehension by the mind without reasoning* (Allen, 1992).

[7] Awareness is the process by which information in the brain is made globally available to motor processes such as speech and bodily action (Chalmers, 1995:66).

[8] There are differences of opinion in the discipline of philosophy about what exactly the definition ought to be. See for example the different arguments in H.W. Johnstone: What is Philosophy (Johnstone, 1965).

ii. Logistic methods (Descartes, Leibniz, Locke, Carnap, Russell). These methods trace knowledge back to the elements that it is composed of and the processes by which they are related. According to these schools, science is organised starting with common primitive definitions and assumptions to which more elements are joined to construct higher orders of complexity, in other words fact nets are formed.
iii. Methods of inquiry (James, Dewey, Peirce). The purpose of these methods are neither to resolve contradictions, nor to organise knowledge into inductive systems based upon primitive principles. Its aim rather is to discover the solution to problems and to advance knowledge in this way. Its methodology therefore is plural, general and common to all sciences.

The apriori starting point of this text will be that problem solving can best be achieved by a method which takes a broad view of problems and that is purposeful in finding solutions to them. Within the context of these parameters, the systems approach is the one that satisfies the selected criteria. For the purpose of this text, Checkland's definition of a systems approach will be used[9]. The work of C West Churchman forms the basis of a powerful general systems theory for a systems approach to problem solving. It is a synthesis of a comprehensive system for inquiry that includes all of the methodologies described by McKeon and his work will therefore serve as the philosophical basis for the text.

In summary, the core concepts identified in the argument are:

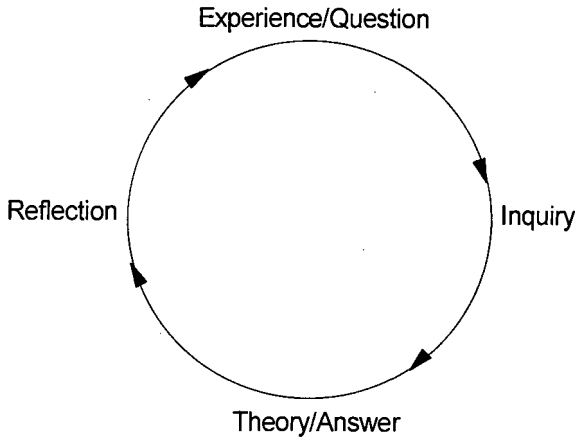
- Complexity and complex systems.
- Learning and learning systems.
- Images of experience (mental models).
- An approach to epistemology[10].
- A systems approach to problem solving.

In keeping with the introductory statement, the flow of this study will be to follow a learning cycle (diagram 1). The cycle that will be followed is an adaptation of Kolb's learning cycle. The problem that has been selected for study will be approached by way of this process and through this a theory for action will be synthesised based upon a systems approach. The object of the study is to contribute to an improvement of health care within an ethical framework.

The study started with an experience: There appears to be a problem with medical process. This lead to the questions: What is the problem and what can be done about it? The questions started an inquiry that identified a systems approach as an appropriate methodology for studying the problem. The application of this approach identified the problem as a complex social problem that is influenced by incorrect assumptions about illness and health care. This is expressed most forcefully in the patient-physician interaction. This finding resulted in a theory that the application of an approach to inquiry that can increase the rigour of assumption testing, both of the intuitive and empirical components of medical decision making, may lead to increased learning and therefore improved medical process. Churchman's work on the design of inquiring systems is a powerful approach to inquiry and is therefore suitable for fulfilling this requirement. The application of the principles of Churchman's philosophy, does indicate a possibility for positive change in medical process. Upon reflection, the systems approach in general and Churchman's philosophy in particular

[9] An approach to a problem which: a) takes a broad view, b) tries to take all aspects into account, and c) concentrates on interactions between the different parts of the problem (Checkland, 1991:5).
[10] The theory of knowledge (Allen, 1992).

may contribute towards an improvement of the problems identified in health care and may answer the question with which the study started.



Cycle of learning of the study
Diagram 1

CHAPTER 1

INTRODUCTION

Medical systems all over the world are on the verge of breakdown. The reason for this is that neither patients individually, nor governments and business institutions collectively, can afford the delivery of health care as we know it any longer. Due to an increase in knowledge, the concepts of illness processes and the interactions necessary to counteract them have grown from very simple to enormously complex biological and social systems. However, these systems are still approached upon the basis that they can be understood in terms of simple causal chains. An approach that could offer a long-term solution to the health care problem would have to conceive illness and medical process as complex biological and social interactions. This will be the central argument upon which the rest of the study will be based.

Assuming that this argument is true, the following questions arise:

- What is the problem with health care delivery?
- How did the problem arise?
- By what process does the problem affect the health care system?
- How can the problem be resolved?

The rest of this chapter will be devoted to introducing core concepts and definitions that will be operative throughout the text and that are necessary for understanding the development of the argument. These are:

1. The purpose or reason for the study.
2. The definitions that will be used throughout the study.
3. A model of causality for complex systems.
4. A concept of learning.
5. The concept of image referred to in the introductory argument.
6. A social system model of organisation.
7. The events that lead to the initiation of the study.

Chapter 2 is an inquiry into the factors that lead to the cost problem in health care. This is done by way of a dialectic argument. Firstly, the traditional position based upon simplistic logic is presented, and then this data is re-analysed in terms of a systems dynamics model of complexity. This shows that the interactions of the health care system are representative of a complex social system. Furthermore, this explains why most attempts to improve the system have been unsuccessful. Simplistic solutions tend to have unforeseen long-term effects that may compromise the system even further.

Chapter 3 investigates the history of health care delivery. This history is one that starts with a single interaction between patient and physician, based upon limited knowledge of illness. Post-renaissance science accelerated the discovery of a large body of knowledge in biology, leading to new treatments that necessitate an interaction with a larger number of professionals and therefore an increase in the complexity of health care delivery. The historical assumption of illness and treatment as simple linear processes still predominate in the thinking about health care. It is imperative that a new paradigm should arise that recognise the complexity of illness and the fact that the health care delivery system now is a complex social interaction.

Chapter 4 is an inquiry into the patient-physician interaction as the basic interaction of the health care system. The purpose of this system is decision making to resolve the problems that patients present with. These decisions initiate the complex interactions involved in treatment and are therefore ultimately responsible for the cost to the health care system. At present, the methodology used is based upon the assumption of a simple linear causal chain. However, closer analysis shows the consultation process to be infinitely more complex. It is influenced by the needs, wants and expectations of patients and physicians, and also by their world view of illness and health care. These images are difficult to quantify and therefore ought to be balanced by empirical knowledge. An investigation into the way that knowledge is acquired and used in medicine shows that knowledge is not used efficiently in the decision making process. It is proposed that a system of inquiry that can improve medical decision making at the patient-physician level may have a beneficial effect on the system as a whole.

For decision making in complex environments and particularly those affecting human systems, an approach is needed that is sufficiently inclusive to address all the complex interactions involved. C West Churchman made an important contribution to our understanding of the decision making process in complex environments. He proposed an approach that is purposeful and takes a broad view of problems, in other words, a systems approach. Churchman was interested in the questions: How do we acquire knowledge and how do we know that we have acquired it? His approach is therefore useful for determining the assumptions that decision making is based upon, as well as the validity of the knowledge used in this process. It is the proposition of this text that the application of these concepts will be useful for improving decision making in the patient-physician interaction. Churchman's philosophy is introduced in chapter 5.

In chapter 6, Churchman's systems approach is applied to medical process and decision making. It is shown that such an approach contributes towards changing the underlying beliefs about health care identified in chapters 3 and 4, and furthermore, can increase rigour in the use of medical knowledge. It is shown that such an approach can lead to an improvement in health care process and therefore lead to a saving in cost when applied to the problems identified in chapter 2. Therefore, a systems approach based upon Churchman's general systems theory could make a positive contribution to medical process and learning.

A framework is needed containing the concepts and definitions from within which the proposed argument can be developed. The following is a discussion of this framework.

1. Purpose of the study

The purpose of this study is to show how the application of a systems approach can improve the practice of medicine. The focus of the study will be the physician-patient interaction as the most basic subsystem of the health care system. The boundary selected for the inquiry is an arbitrary one and in no way reflects the reality of the system in terms of the whole. The core components of this system are taken to be the patient, the family practitioner (FP)[11] and the specialist. The study will show that the interaction between these systems have a profound effect on the delivery and cost of health care. The patient-physician system is a part of the health care system within which it interacts with other system components, such as health care administrators, hospitals and the pharmaceutical industry.

[11] The term family practitioner is preferred to general practitioner in the modern discipline of family practice. The term generalist as opposed to a specialist is also used to identify family practitioners.

2. Definitions

The following definitions about health care will be operative throughout the text.

- Medicine in this study is defined as: *the practice (professional work) of diagnosis and treatment and the prevention of disease.*
- Health care is defined as: *to look after a person's mental or physical condition* (Allen, 1992).
- A health care system will therefore be: *a system that looks after a person's mental or physical condition.* The health care system includes the following components: patients (clients), physicians, nursing care, hospitals, pharmaceutical workers, para-medical workers, administrators, etc. Some of these components in turn are systems containing sub-systems. In the current system the interaction of these components and systems enables the delivery of health care to patients.
- The patient-physician system is a system where people (patients) consult a professional about a change in their physical or mental condition for the purpose of obtaining reassurance, or to have the change restored or altered to their satisfaction.

3. Complex systems and causality

According to the popular image of science, everything is in principle predictable and controllable (Bateson, 1979:40). If this is not the case, it will become possible when we acquire more knowledge. This perception is based upon the Cartesian system that is considered to be the start of modern philosophy (Johnstone, 1965:5). This system has three rules:

i. Never accept anything as true that cannot be clearly shown to be true.
ii. Divide every problem into as many parts as possible to adequately explain it.
iii. To reason logically, start with the simplest known facts and assemble them into more complex entities (fact nets).

This (reductionist) approach is the cause of two assumptions on which the image of science is based, namely:

i. Knowledge is finite and if we can identify the simplest truths, it is potentially possible in time to collect all possible knowledge in the universe and construct it into an interconnected whole.
ii. The collection of knowledge is a sequential linear process.

These assumptions form the basis of the linear cause and effect model that has been used with great success in modern science. This deterministic system is the dominant view of causality in Western science and technology (Feinstein, 1988). However, this system has been far less successful dealing with complex systems.

Linear causality is based upon "if...then" logic. For causality to exist, the cause has to be both necessary and sufficient for the effect to take place (Ackoff, 1981:10). Therefore, one object under investigation is the cause of another object under investigation (its effect), if both objects belong to the same natural mechanical system and the first object precedes the second in time (Ackoff and Emery, 1972:21).

This concept was challenged by E.A. Singer, who proposed a producer-product model of causality. According to this model no individual producer is ever sufficient for a product, therefore every product has at least one co-producer. In other words, the producer is necessary for the product but not sufficient. The emphasis is on the relationships between the parts of the object under investigation, rather than the object individually. To identify all co-producers, the possible contribution of all aspects in the environment of the problem has to be considered when an attempt is made to determine causality (Ackoff, 1981:20). In other words, a broad view has to be taken. Furthermore, a single producer can have a number of different products and different products may have the same producers. This model has particular relevance to the study of complex systems.

At the end of World War II, the notion developed that causality in complex systems is circular and not linear (Bateson, 1979:103). This concept of circular causality was further developed as systems dynamics within the systems community (Flood and Jackson, 1991:61). It means that a producer will produce a product that will be the producer of another product etc., in a never ending cycle[12]. Circular causality or feedback loops imply that every element is both cause and effect at the same time. Two kinds of causality loops can be identified (Senge et al., 1994:114; Senge, 1990:79):

i. Reinforcing (positive feedback) loops that lead to amplified growth or decline.
ii. Balancing (negative feedback) loops that limit growth.

When applied to complex systems with many interactions, models with multiple causal loops (a systems dynamics model) can be developed. This creates a powerful method for perceiving:

- interrelationships; and
- processes of change in complex systems.

The advantage of such an approach is that hidden causes of problem situations are exposed and that an idea can be formed of the possible effects of any intended changes to the system.

A systems dynamics model is therefore the only reasonable model available at present for understanding the interactions of complex systems. Furthermore, these concepts can only be meaningfully introduced through a sufficiently broad approach to the problem, in other words a systems approach. This will therefore be the operative model throughout this text.

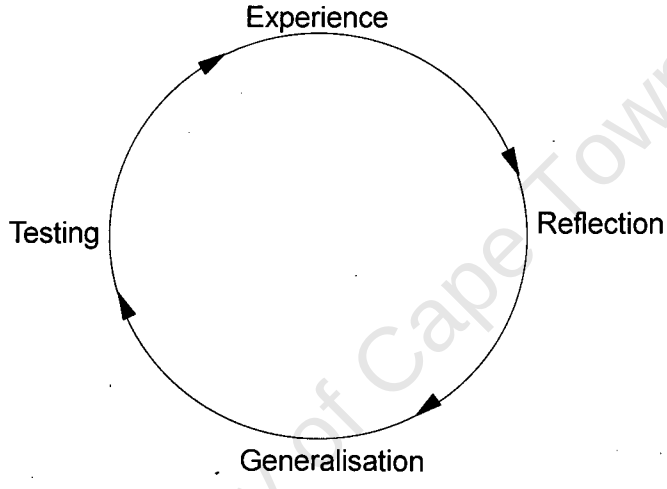
4. Learning[13] systems

In the introductory argument, it was stated that learning and the ability to adapt has a survival advantage. Companies and governments who have not learnt to adapt or have adapted too slowly go out of business (Ackoff, 1981:4). Adaptation and learning are also fundamental to systems methodologies (Flood and Jackson, 1991:5; Churchman, 1979:65). The process of learning takes place within a distinct sequence of events and the framework within which this study will be presented will be that of a learning system, in other words, a system that gains knowledge through inquiry and experience. For the purpose of this study Kolb's system (Kolb, 1984) will be used, since it is designed from a comprehensive and inclusive foundation, in other words it satisfies the parameter of a broad view selected for this study .

[12] Bateson credits Rosenblueth, Wiener and Bigelow for proposing the self-correcting circuit and its variants (Bateson, 1979:106).
[13] Learning is the process whereby knowledge is created through the transformation of experience (Kolb, 1984:41). Or, learning is an increase in the degree of knowledge or understanding over time (Ackoff and Emery, 1972).

Kolb's learning cycle in common with other learning cycles has four stages (diagram 2).

i. There is an experience.
ii. Reflection on the experience follows. During this phase the experience is integrated with current knowledge. Further knowledge is gained through a process of inquiry, during which more information is collected in order to enable the reflective phase to be as complete as possible.
iii. Generalisation. New actions are planned and a hypothesis is formed (decision making).
iv. Testing the hypothesis (implementation). This is followed by an experience of the reaction and the cycle is therefore completed and restarted by observing the outcome.



Kolb's learning cycle
Diagram 2

Kolb made the following important contributions to our understanding of the learning process.

- Learning takes place as part of experience.
- Learning is based upon a process of feedback (it is a circular process).
- Learning is purposeful (the pragmatist position).
- Learning takes place within the framework of its environment (a systems concept).
- All learning systems are essentially similar.

Kolb's philosophy of learning is based upon the action research of Kurt Lewin, John Dewey's model of learning and Jean Piaget's model of learning and cognitive development. It was also influenced by the work of Paulo Freire, Ivan Illich and the philosopher Stephen Pepper.

Kurt Lewin's work emphasises the immediacy of experience to validate and test abstract concepts, and secondly is based upon feedback processes (a cycle). The latter provides a basis for a continuous process of goal-directed action and the evaluation of the consequences of the action. Dewey contributes a philosophical base towards Kolb's concept of learning by introducing the idea of purpose (the pragmatist position). The concept of personal observation based upon experience of the environment is Piaget's contribution.

Kolb makes the important observation that not only these models of learning, but also others are remarkably similar. He infers that learning by experience:

- Is best conceived as a process and not in terms of outcomes;
- Is a continuous process based upon experience;
- Requires the resolution of conflicts between dialectically opposed modes of adaptation to the world (a position similar to that of Hegel and later Singer);
- Is a holistic process of adaptation to the world (i.e. systemic); and
- Involves transactions between people and their environment.

Ideas are not fixed, but form and re-form through experience. Learning is therefore a process by which ideas are continuously changed. Knowledge is continuously formed from and tested in the experiences of the learner. The implication of this is not only that new ideas are introduced, but old ideas have to be modified or disposed of as well. Resistance occurs when new ideas are in conflict with or inconsistent with old ideas. The learning process can be facilitated when the beliefs and theories (images) of learners are examined and tested before they are confronted with new ideas. This is the principle of a learning system and can be achieved in practice for example by the use of scenarios[14] (De Geus, 1988).

Ideas that are integrated into people's belief systems tend to become more stable than ones that are substitutes for earlier ones. The former are easily reverted to in future states of uncertainty. The process of learning therefore consists of a continuous challenging of current mental models and adjusting them. This has an important implication for planning and change.

According to Ackoff and Emery (Ackoff and Emery, 1972) the processes of perception, consciousness and memory are used to form a description (image) and explanation (conception) of a situation. From the description and explanation a set of beliefs are formed that are organised into a model (world view). The concept of ideas or mental models will now be developed further.

5. Mental models

In 1956 Kenneth Boulding wrote *The Image* (Boulding, 1987). In this work he described the concept that through knowledge we form images of the world and that these images largely govern our behaviour. (This is similar to Bowler's concept of mapping (Bowler, 1981:43)). The image is based upon what individuals believe to be true and is altered by messages received from each event in which they partake (in their environment). Our image of the world is not uniformly certain or clear and tends to resist change, particularly if messages that are received are contrary to our value systems. To overcome the resistance, a very strong message is needed and when it is overcome, the effect will often be to reorganise or realign the whole knowledge structure. This is effectively a paradigm shift as Kuhn described it (Kuhn, 1962). The image also implicitly or explicitly has an influence on everything that we think or do (Flood and Jackson, 1991:6).

[14] Scenarios represent alternative outcomes in uncertain environments. They can assist in changing assumptions about the world (Wack, 1985).

5.1 IMAGE OF SELF

One of the important images of early development is the image of self or personality[15]. This is a complex image and subject to continuous adjustment mainly through the influence of the environment. The image that other people have of you can influence the image that you have of yourself and therefore also the way that you act. Vickers makes the important point that images of social roles are vital for the functioning of a community. For example, if policemen or judges do not practise the roles expected of them, the concept of law that a community has cannot be applied (Vickers, 1980:5).

Later in this study, it will be shown that the image that the community has of physicians as professionals has an important effect on the health care system.

5.2 RESISTANCE TO CHANGE

The balancing of opposing forces makes systems possible and all systems will have a tendency to seek a balance between two opposite poles (equilibration). In complex systems equilibrium cannot be attained. Systems will resist any drift towards polarity and the stronger the stimulus away from the mean, the stronger the resistance against it will be (Bowler, 1981:4). Images are no different in this respect. Messages that are in defiance of an existing image will often be ignored or discarded. The more different they are the more likely they are to be resisted.

The opposite is also true. An example is the parable of the boiled frog. It has been said that if you heat the water in a pot with a frog inside slowly, it will boil before the frog will try to escape. The difference between the message and the image is small enough to be accepted until it is too late. The boiling is the price to be paid for imperfection. Mistakes in human communication are made all the time and are usually not even noticed unless the difference in perception leads to a significant problem. This imperfection ensures the necessary robustness that prevents us from being swamped by an overload of information. It therefore increases efficiency but sacrifices accuracy.

The mistakes that are made when we are not able to discern sufficient dissimilarity to register difference can be explained by Bateson's proposition that perception operates upon the recognition of difference. The organism therefore receives information about and acts upon the registration of sufficient difference (Bateson, 1979:29).

5.3 PERFECTION OF IMAGE

Knowledge[16] is incorporated into an image. However, we have no way of corroborating the truth or accuracy of the knowledge or the image[17]. This is the age old problem of philosophy, namely what is knowledge and how do we recognise that we have knowledge. In the absence of reasoning, we assume our observation, and therefore knowledge, to be accurate. This is a potential source of error that affects the way we build more complex images or fact nets, leading to the same weakness inherent to logistic

[15] The distinctive character or qualities of a person (Allen, 1992).

[16] Knowledge results from the grasping of experience and transforming it (Kolb, 1984:41).

[17] According to Bateson (Bateson, 1979:27), science can disprove or improve a hypothesis, but never prove one beyond any doubt. Popper (Faure and Venter, 1993) takes this one step further by postulating that knowledge advances by the modification of earlier knowledge and therefore the acquisition of knowledge is the discovery and elimination of errors. The problems of scientific knowledge (or image) is the same as that of personal knowledge, the difference is only in the system involved.

systems of reasoning (such as the Lockean inquirer introduced in chapter 5). In other words, a small initial error can lead to a large error in more complex images developed from them. This then argues for the examination of knowledge by reason, rather than by intuition.

5.4 SHARED IMAGES

Our image of the world includes a belief that it is shared by others who are in effect part of this world image. Images develop as a part of the culture or subculture within which they develop. The concept of public knowledge depends upon the basic similarities of the ideas amongst people.

This idea is also underlying to current belief systems about group learning. The object of group learning is to make shared images and assumptions explicit. In this way images can be altered or manipulated to the advantage of the group, corporation, etc. (Senge, 1990:17,233; Senge et al., 1994:134). The most successful organisations in the future are likely to be those who exhibit group learning (De Geus, 1988), in other words where learning will take place throughout the organisation (learning organisations). Most of the assumptions we hold are acquired from a pool of culturally acceptable assumptions. In the same way we have assumptions about organisations, how they function, and our roles in it. These assumptions are often incorrect and learning about the organisation takes place when they are challenged and altered. When the assumptions of groups in the organisation are challenged, there is a tendency for members of the group to develop a better understanding of the assumptions of other members. In this way an alignment of ideas takes place and shared images are formed. This is fundamental for the functioning of organisations that are functioning as social systems, a concept that will be discussed later in this chapter.

The process of group dialogue is a useful practical method for revealing the incoherence of our thoughts (Bohm quoted in Senge, 1990:241) and to explore complex issues from many points of view. The aim of dialogue is not to seek agreement but to form a richer grasp of complex issues. Group dialogue makes a larger pool of meaning accessible to the group, in other words when members pool their collective ideas, the IQ of the group as a whole can be increased.

When two or more individuals share an image of sufficient similarity they may start acting purposefully together to the benefit of both. Once this happens a simple social system has been created. The decision to interact depends on the individual's purpose. It is the assumption of this study that the purpose is to be found in individual need satisfaction and that a satisfactory model for this is that described by Maslow (Maslow, 1968). This model is based upon a holistic view of man and consists of a hierarchy progressing from simple to complex needs. The underlying philosophy is therefore essentially systems orientated. Maslow identified the following needs that individuals seek to satisfy in a sequential manner:

- Basic needs. These are the simple physical needs of physiology such as hunger, thirst, etc.
- Safety needs. These are the desire for security, stability, protection, freedom from fear and chaos and needs for structure, order and lawfulness.
- Need for belongingness and love. These are the needs for friends, affective relationships and group belonging.

- Need for esteem. The desire for power, achievement, recognition, etc. The need for belonging is more concerned with affection as opposed to the need for respect, the context of which is determined by the internal judgement of a person.
- The need for self-actualisation. This is the need to realise one's own potential.

In a society, culture, or organisation, there is a public image, the essential characteristics of which are shared by the individuals in the group. A large part of the activity of a society is concerned with the transmission and protection of its public images. These images are also handed down to new generations by what Boulding calls a transcript. As a result of this transcript the associated value system will tend to select those messages that conform with the tradition of the transcript. An important image acquired by society is the value image. Establishments such as education play an important role in instilling the value system of a society, the most important reinforcement being from the peer group. Successful images often become the most dangerous when they become institutionalised. It is in this way that both the scientific and medical communities have managed to isolate themselves from their surrounding society. It will be shown that the images of illness, professionals and health care are shared images and that they contribute towards the problems in the health care system.

6. Models of organisation

Ackoff (Ackoff, 1981:25) developed a model that is useful for interpreting organisations. This model consists of the following:

- Mechanismic conceived organisations.
- Organismic conceived organisations.
- The organisation conceived as a social system.

The Cartesian world view was referred to earlier in this section. This view lead to a concept of the universe as a machine that consists of parts and interactions that can be analysed by reduction. This is the mechanistic view. The purpose of organisations as machines is to provide their creators with an adequate return on their investments, in other words to produce a profit. Workers are parts of the machine and consequently their personal objectives are irrelevant. In this model there is an emphasis on the efficiency of the parts and on external control (Flood and Jackson, 1991:8).

The introduction of the concept of cybernetics lead to a view of an organisation as an organism. In this metaphor, the purpose of the organisation is survival and growth and profit a necessity for survival. Management is the brain of the organism and as such has to accept full responsibility for the organisation. The well-being of the workers now becomes the concern of the organisation, but this does not include an interest in their personal needs. The organisation receives inputs from its environment and dispenses outputs back into it. Similarly, management receives information from the different sections in the organisation and send back outputs as instructions. There is therefore an emphasis on the flow of information.

These metaphors are now being replaced by the concept of the organisation as a social system. This implies an organisation that:

- Is a purposeful system in its own right;
- Is itself part of one or more other purposeful systems; and
- Consists of parts (people) who have purposes of their own.

The functioning of such an organisation depends upon the interaction between itself and the people it consists of, as well as between itself and the other systems of which it is a part. In such a model therefore, the actions of the organisation has effects at many different levels, since it is part of a complex social system. The problem of management now becomes one of integrating the purposes of the organisation with that of its employees and also with the systems that it is part of to ensure optimal function. These purposes are often at odds with each other. The social organisation is therefore a metaphor consistent with a systems approach.

The political metaphor described by Flood and Jackson is a another one that is useful (Flood and Jackson, 1991:12). The emphasis is on competition and the pursuit of power between groups (and individuals). The character of such organisations can be unitary (common objectives between members), pluralist (diverging group interests), or coercive (oppositional and contradictory interests). This metaphor is common in political systems.

7. Purpose

Ackoff (Ackoff, 1981:34) understands purpose to mean the ability to select one's own objectives (ends) and the means (actions) for pursuing them. Objectives and means are selected by a process of inquiry that leads to choices. Preferences for particular means and ends as well as available knowledge are the parameters used to make an informed decision. Ends that may be pursued are:

- Goals: desirable objectives that may be obtained within a specific time limit.
- Objectives: desirable outcomes that will not be attained within a particular period of time, but may be obtained at a later time.
- Ideals: desirable outcomes that can never be attained, but can be approached indefinitely.

Churchman's method of inquiry is a useful method for selecting means and ends and will be discussed in chapter 5. The selection of ends, in particular, is of importance, since such selection necessitates the inclusion of values or ethics in the decision making process. It is in this area that Churchman's method has particular merit.

8. Control and responsibility (Strümpfer, 1994)

Control: *the power to direct, command; a means of restraint* (Allen, 1992).
Command: *have authority or control over.*

Inherent to all these metaphors is the problem of controlling the organisation. The underlying assumption in mechanistic organisations is that control is at the level of environmental inputs. Once the input enters the system, the flow can be controlled in a predetermined manner, in other words, it is possible to guide the inputs in the system by a set of specifications. Control is therefore external to the system and static.

In the organismic metaphor, the locus of control is the flow of information. The brain, or management, receives an input of information in response to which it sends out information about objectives that it had decided upon. Consequently, there is an emphasis on the measurement of performance and the co-ordination of actions. Control is therefore internal to the system.

In the organisation as a social system control takes place by way of aligned self-control. The emphasis is on a shared understanding by all the parts of the purpose of the system and the

context within which it operates. An understanding of the vision[18] of an organisation ensures participation and therefore enables the parts to act in a co-ordinated way through self control. The emphasis is on vision, alignment[19] and empowerment and the processes necessary to achieve that.

Both the mechanismic and organismic models assume a linear model of causality, which imply that it is possible for a person or persons to control resources and variables to produce a particular output. The organisation as social system is designed on a systems dynamics model within which it is impossible to be in complete control. The concept of responsibility[20] within such a system therefore has no meaning.

Responsibility can also mean to have authority, in other words the ability to act independently and make decisions. Authority[21] in mechanistic and organismic models is power over others. In the social system model, it means the power to achieve desired objectives (power to, rather than power over).

The organisation as a social system model will be the operative metaphor for this study.

9. The events that led to the perception of the problem

I became aware in my practice[22] that the traditional paradigm that I had been taught is inadequate. This awareness is based upon the experience of interactions with patients[23], other colleagues, other players in health care (nurses, administrators, pharmacists, etc.) and finally the trends observed in my practice records. I observed many frustrations to both physicians and patients in the health care system and also that health care delivered is often not of a reasonable quality. I learnt from interacting with traditional structures that they are unable to change the situation for the better. I therefore deduced that a new paradigm is needed to study the problems of health care. An inquiry into such paradigms leads to the argument by which this text has been started and therefore a systems approach as a possible solution .

It is my perception that three problems are fundamental to the issue[24] .

i. Health care workers do not share a well-constructed world view (image) of the profession as a whole and consequently have difficulty in forming an understanding of the problems that they face.
ii. The reason for this is that the world view available for them to act upon, is the structure and interaction observed by them as students in teaching hospitals. This is a flawed model and inappropriate when health care is viewed as a social system.

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[18] Vision: a statement of where we want to go and what we will be like when we get there, in other words it is a picture of the future you seek to create for yourself (Senge, 1994:302). This is very similar to an ideal as an objective.
[19] Alignment: when a group of people function together as a whole (Senge, 1990:234). Unaligned groups may work very hard, but their efforts are at cross purpose and therefore inefficient.
[20] Responsible: *liable to be called to account* (Allen, 1992).
[21] Authority: *the ability to act independently* (Allen, 1992)
[22] The author is a medical practitioner (family practitioner 1978 to 1980, registrar in urology 1981 to 1995, consultant urologist in an academic hospital 1995 to 1987, and a specialists urologist in private practice since 1987).
[23] Approximately 13 000 individual consultations.
[24] The author has served on a hospital board, was an elected representative of local physicians in negotiations with medical insurers and private hospitals, served as secretary for a medical specialist forum and has lectured to medical and lay audiences.

iii. This lack of an image of an appropriate structure for interaction leads to an inability to communicate constructively (Balint, 1986:49; Grant and Dixon, 1987), both between physicians and patients, and between peers.

It is my belief and the thesis of this study that changes based upon systems principles at the level of the patient-physician interaction could possibly solve the dilemma that I have experienced. Broad issues relevant to the problem are:

- The problem owners. The health care crisis fundamentally affects the patient and physician who are the core sub-systems. The patient and physician are therefore those affected by the decisions of the planners of new health care systems. Since this interaction cannot be separated from the whole, society as a whole is also a problem owner. A further problem is that the decision takers at present do not consult with the affected, which creates an obstruction to the implementation of their plans.
- The decision takers. The problem has become one of a village common type (Kauffman, 1980:33)[25]. The limited resource that the competitors in the health care system compete for is health care funds and it is no longer possible for the medical profession itself or patients on their own to resolve the problem. Both these communities will have to be assisted either by government, or by medical administrators who are in a position to implement changes. However, both physicians and patients ought to be part of the planning of a system that will be able to address the problem. It is vital that they should learn how their actions affect the system as a whole and this can be ensured through their participation in planning.
- The symptom. The symptom of the health care crisis, is a cost problem that is out of control. The suggested solution to the problem lies not in focusing on the symptom of cost, but to address the system as a whole in terms of its structure and interactions.

The purpose of this chapter was to introduce the argument of the study and the core concepts from which the argument will be developed. The first part of the argument will be introduced in the next chapter, when the question: What is the problem with health care delivery and what events lead to the problem will be addressed.

[25] The problem is initiated when people benefit individually from a shared common resource that initially appears to be unlimited. Activity grows larger than the resource which is then exhausted. At this stage, the problem cannot be solved in isolation from fellow competitors. (Kim et al in Senge, 1994:141).

CHAPTER 2

THE NATURE OF THE PROBLEM

It is argued in this text that health care systems are on the verge of breakdown. The purpose of this chapter is to investigate and identify the reasons why the system is in trouble, hence it is an attempt to answer the question: Why is there a problem? In the first part, the investigation is in terms of the usual simplistic linear approach. This identifies cost as the most important symptom of dysfunction and therefore the focus of attempts to improve the situation. In the second part, the same data will be presented within a systems dynamics model. This will show the dialectic opposition of the two approaches and also the advantage of investigating the problem by way of a model that is sufficiently powerful to show the many complex interactions involved. In terms of such a model, the causes identified interact in numerous ways to cause the cost problem. Attempts to re-engineer these interactions in a simplistic way is likely to affect other interactions and may therefore compound the problem. In the last section, historical attempts to solve the crisis in a simplistic way are discussed. Compared to the systems dynamics model, it becomes clearer why they have been unsuccessful and why a systems approach could potentially offer a better alternative. Therefore, the health care system is a complex social system and could benefit from being approached as such by health care planners.

1. The problem

The modern version of the health care system is the product of a long history of interaction between the social community and medical professionals. The physician's purpose at present essentially is to return members of the community to a physically and mentally sufficiently healthy (well) state, so that they can continue to interact socially in the way that they want or have to. The health care system exists because of a need of the community (Kuhn, 1962:19) for members who are prepared to tend to their health needs and it can therefore not be separated from the social system as a whole.

The medical profession as we know it today is essentially a product of the Western scientific and philosophical tradition. Like many similar systems the modern health care system is in conflict with its environment and also has to contend with a change of value systems away from the technological-scientific approach (De Wet, 1991:46)[26]. The result is that the profession is in a crisis but no clear model or approach appears to be available to address the problem. The problem is not that of regulation but a social one (Levinsky, 1984a)[27] and medical practice therefore is in the middle of a profound transition (Eddy, 1990c).

Indications are that the Western health system has failed to improve the health of people in many countries, particularly third world and poorer countries. Even in the USA a large number of the poor; 37 million, or 14% of the population (Holtgrewe, 1993), do not have

[26] According to Vickers, through science and technology mankind acquired the power to change their environment. These changes caused numerous unpredictable repercussions in the complex systems in which they intervened, causing the need for further intervention, more change, etc., in other words a reinforcing feedback loop. The problem is that humankind's ability to change the environment outstrips its power to control the environment and also the effects of the changes that they make (Vickers, 1968:42).

[27] Humankind through their interventions, replaced the physical with a social milieu as the most important area of human interaction (Vickers, 1968:42).

reasonable access to affordable health care. The symptom of the failure is a cost crisis and this issue will be the focus of the rest of this chapter.

The cost problem is a highly complex one. It is partially the result of world-wide economic realities and partly the result of spiralling medical costs that increase at a rate higher than the average inflation rate (Iglehart, 1992a; Iglehart, 1991).

2. Reasons for the problem

The following reasons are commonly considered to be the most important causes of the problem:

2.1. Most governments can no longer afford their contribution to health care (Fuchs, 1984). This is an economical problem to which the health care problem contributes significantly in some countries.

There are essentially four health care systems functioning in different countries of the world (Iglehart, 1991) and all of them, to different degrees, struggle to contain cost.

i. A predominantly private sector model (USA, Switzerland).
In the USA health care spending has increased by 1 379% from 1967 to 1991 and is expected to be 3 000% above 1967 levels by the end of the century (Holtgrewe, 1993). In spite of this, life expectancy is lower and infant mortality rates are higher than other first world countries who by comparison spend less on health care. An increasing number of patients are no longer able to afford increasingly expensive health care. In this model, these patients are often left with no health care at all.

ii. A national health system (NHS) model (UK, Sweden).
The health care cost crisis is not unique to countries with highly developed private systems. Britain's famous NHS has been suffering from the effects of cost constraints as well and efforts to restructure it into a more efficient system is an ongoing concern in the UK (Glaser, 1993; Frankel, 1991).

iii. Social-insurance model (France, Germany, Netherlands).
This appears to be the model that has had the best record at present (Iglehart, 1991)[28]. It is a combination of government-mandated financing by both employers and employees, combined with the provision of private health care by physicians. Hospital expenditure is controlled and administration is done by non-profit organisations. Every German citizen has comprehensive medical cover with a free choice of physician. Most physicians are not allowed to give hospital care and those that are registered to do so are salaried. An important reason that the German system works is German value systems. (The value system is a function of the shared cultural images of the German people in terms of the discussion in the previous chapter). The German cultural preference is for reaching compromise before deadlock occurs, in other words Germans are more likely to compromise and accept communal decisions than other cultures, the implication being that their system will not necessarily work in other countries[29]. Furthermore, the cultural ability of competitors in the system to work together, dulls the effect of the village commons cycle that is more noticeable in other countries.

[28] The fact that this system works, is an indication that it is operating in a socially acceptable way (Iglehart, 1991).
[29] See for example the interview with Emmanuel Todd in Newsweek (January 29), 1996.

iv. Government health insurance model (Canada).
In Canada, the health care system is the nation's most popular publicly financed service (Iglehart, 1986). All of Canada's citizens receive care through their health schemes, which is the bulwark of the country's social programs. The problem is that Canada is facing a massive budget deficit, which means that the support for health insurance plans has to be reduced. This is politically almost impossible to do since 80% of Canadians are happy with the plans as they are. The health plans in turn are driven by unlimited patient demand, no controls on provider volume, and an emphasis on hospital care, which by comparison is very expensive. The Canadian provinces in 1986 paid one fifth to one third of their revenues out to health care. The government's solution to the problem has been to limit the right of physicians to work in any area of their choice and a reduction in physician salaries. This has, as to be expected, lead to an immediate confrontation between the medical profession and government.

Many governments have nurtured for political gain the availability of health services without informing their constituents of the eventual cost attached to such benefits. The situation now exists where this cost has become a significant problem and urgent solutions will have to be found to solve the crisis.

2.2. There is a world-wide over supply of physicians (Anonymous, 1991). The principle that the training of a larger number of physicians will lead to more competition and therefore a containment of cost (an economic model, based upon the mistaken assumption that health needs are finite) have had exactly the opposite effect (Glaser, 1993). An important factor in rising health care costs is the number of physicians in the system (Wennberg quoted in Holtgrewe, 1993). It is projected that in the USA by the year 2000 there will be an over supply of physicians in disciplines such as surgery, ophthalmology, gynaecology, etc. and equal demand in all remaining disciplines except psychiatry in which there will be a shortage (Kaplan and Sadock, 1991a). Each physician creates work to survive, some of which will be unnecessary or of dubious value (Holtgrewe, 1993). It has been shown that there are twice as many surgeons per population in the USA as compared to England and Wales and that they perform twice as much surgery (Bunker, 1970). The reasons for this can be many, but one is that the number of physicians determine the amount of work that will be performed (Wennberg, 1986).

In spite of the over supply there is a geographical maldistribution of physicians. Most physicians will elect to work in a more affluent metropolitan area for obvious reasons (better income, better socio-economic environment, better education, etc.)(Stimmel, 1992). It has been suggested that the patient physician ratio in South Africa is within the recommended norm (Benade, 1992), but with 78% of physicians in metropolitan areas they are severely maldistributed (Botha et al. 1986).

2.3. Unlimited patient demand (or wants). (Needs must be satisfied but wants not)(Frankel, 1991; Samuelson, 1993). According to Hupkes (Hupkes, 1992), economics aims to find optimum ways of utilising scarce resources in order to maximise the satisfaction of needs. He divides needs and wants into those of the individual and those of the community. According to him health care is not a commodity that can be bought or sold in the market place and it will therefore not be influenced by the usual market forces. The demand for health care is often a derived demand (be it primary or curative health services) decided by the suppliers, in other words the health care system itself creates wants that will ensure it's profitability. The satisfaction of these wants is often not to the patient's benefit (but usually cause no harm) and add to the cost spiral. Furthermore, health care has been regarded by both consumer and provider as an infinite resource, an initial condition for a village common situation. The economic reality is that no society

can any longer support all of its social wants. Painful decisions will have to be taken in future to establish priorities and needs, a scenario foreseen earlier by Vickers (Open Systems Group, 1984:129).

Most business approaches to health care are based upon a needs-wants (supply-and-demand) model. The problem is that those conditions that drive competition in the regular market place do not exist in health care systems (Teisberg and Porter, 1994). The reason was stated above, namely that health care is not a commodity[30] and the rules for supply and demand are therefore not applicable to it. In other words, it has no balancing loop.

2.4. A health care model focused on high technology hospital based care (Holtgrewe, 1993). According the Holtgrewe, before the 1930's Americans paid 80 to 90% of health care costs out of pocket. The introduction of hospital plans after that favoured a system of hospital insurance rather than health insurance. This resulted in lucrative incomes for such institutions and subsequently an emphasis on medical care in hospitals. The latter also installed high technology facilities to attract physicians and with them their patients to ensure continuing profits (Marwick, 1992). This position has created a market for high technology medical research. In the USA, the expenditure on medical research and development increased by 24000% from 1940 to 1970. It will be shown in chapter 3 that this shift of emphasis had three unforeseen results.

i. A business opportunity for profit arose that has been exploited.
ii. Patients perceived a shift of responsibility for cost away from themselves.
iii. These two factors lead to an altered image of health care in society, including a shift towards hospital care as the operative paradigm in the health care system.

2.5. There is evidence that the actions of physicians contribute to an increase in cost. Many health care systems are structured in such a way that physicians have an incentive to abuse the system. It has been shown that the fee-for-service (FFS) remuneration system plays an important role in physician behaviour (Broomberg, 1990; Broomberg and Price, 1990; Price and Broomberg, 1990; Anonymous, 1991). It has also been shown that the method of remuneration in a controlled environment has an effect on decision making (Hillman et al. 1989; Hemenway et al. 1990; Milstein et al. 1989).

Medical education is becoming extremely expensive. The ability to generate a high income to repay bursaries and study loans therefore becomes imperative for the newly qualified physician in order to survive (Colborn, 1992; Stimmel, 1992). An early incentive is therefore created to abuse the system of payment once qualified.

There is a perception, with good reason, that physicians are amply remunerated and that this must be curtailed (Ragg, 1993). Furthermore, this perception is one of the causes for the high litigation rate in countries such as the USA (Claassen and Verschoor, 1992:2). Patients feel that physicians earn large amounts of money and therefore have to take more responsibility for their actions (De Wet, 1991:5; Claassen and Verschoor, 1992:2). Because highly complex interactions can only be partially controlled and physicians are liable to make mistakes, this leads to litigation, high malpractice insurance fees, higher tariffs, etc., in other words a positive feedback mechanism that reinforces the cost spiral.

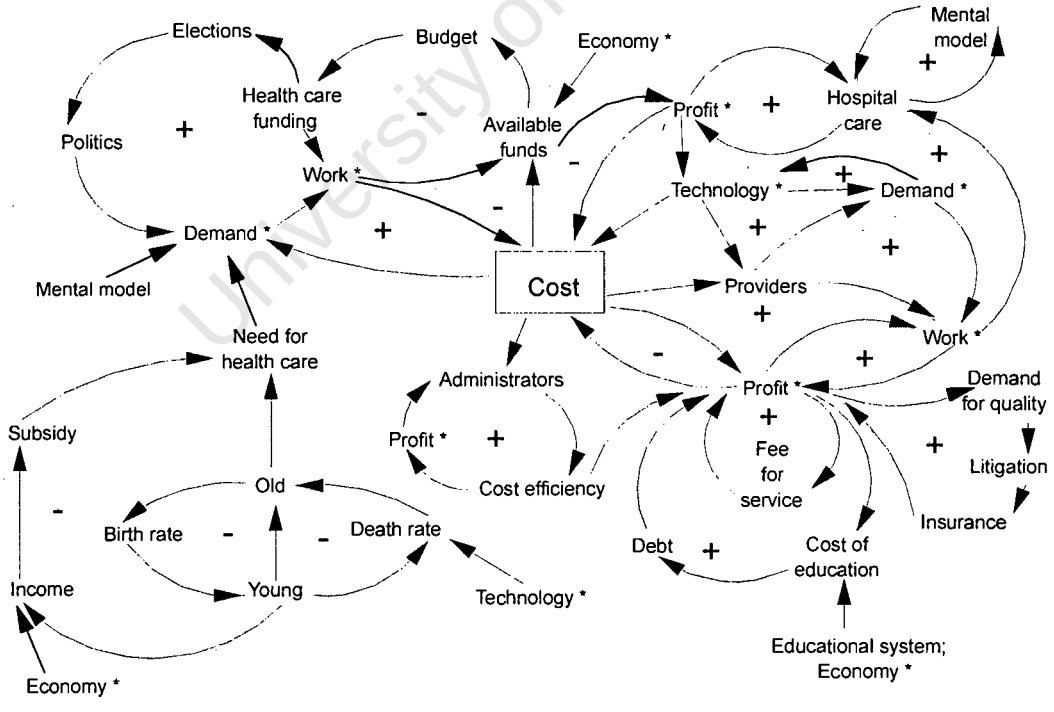
[30] Commodity: *an article or raw material that can be bought and sold, a product as opposed to a service* (Allen, 1992). Health care (see definition on page 12) is a service and not a product and illness a need. Withholding or limiting a service of which the purpose is to satisfy a human need is ethically indefensible. The dilemma is with the satisfaction of wants.

Medical administrators in many cases are in conflict with both patients and physicians. Their aim is to spend less than they have received in premiums. In the case of the physician this means that physicians have to assume costs for services already provided that neither administrator nor patient want to pay for. This creates an incentive to recover these losses in other ways (Teisberg and Porter, 1994).

2.6. The ageing population (Samuelson, 1993). It is a principle of most health care systems that the healthy younger people who work cross subsidise elderly people who are more likely to suffer from chronic illnesses (Glaser, 1993). In theory, when the young people age they will be supported by the next generation, etc. Most first world communities have a zero or negative population growth rate. The number of younger people needed to support older people are therefore simply no longer available. The elderly now account for more than a third of all health care expenditure and people over 85 years of age have the highest per capita health costs (Iglehart, 1992a; Anonymous, 1991; Faltermayer, 1994). Cross subsidisation also takes place between the employed and unemployed and the well and ill, which means that payment for health care is a system for the transference of wealth (Holtgrewe, 1993).

3. The problem as a complex social system

The reasons for the cost crisis appear to be deceptively simple. This is because they have been presented in the format of a traditional linear system. Furthermore, this is the way that most planners and decision takers have looked at the problem until now. However, when the problematique[31] of the health care crisis is illustrated in a systems dynamics model with circular causality as in diagram 3, the format of the problem changes to that of a complex social system with its attendant multiplicity of interactions.



A circular causality model of the problematique of health care
Diagram 3

[31] Ackoff uses this term in the sense of a set of two or more interdependent problems that constitute a system. (Ackoff, 1981:52). The term mess is used by him as an alternate word.

The interactions illustrated here are only the major ones. There are numerous others that may also be relevant to the problem on closer inspection, such as the influence of economical and educational systems. For the sake of readability, demand, economy, technology and profit have been inserted in more than one location in the diagram and are marked with an asterisk to denote this. This is an artificial separation and the correct interpretation is:

- Demand for health care is created through election promises, improved technology, an ageing population, by service providers (this creates work for themselves in order to increase profits), and as a result of mental models (the latter will be explored in chapter 4). Increased demand leads to more work and hence increased cost, which feeds back to increase demand. Increased profits lead to an increased demand for quality of care and feeds into the litigation loop. Demand loops are reinforcing loops.
- The economy determines the amount of money available to governments for health care funding and education. It also determines employment opportunities and the income of economically active members of society who subsidise the elderly. Hence, it is part of the environment that cannot be controlled by health care decision makers and constitutes a balancing loop.
- Technology increases longevity by decreasing the death rate. It also contributes to patient demand for health care and attracts service providers to hospitals. These are all reinforcing loops.
- Profit is made in this model by administrators, service providers, hospitals, etc., who all compete for the same resource, namely health care funding. The availability of this resource is balanced by the economy.

In terms of the systems dynamics model, the mess can be re-interpreted as follows.

- Governments are constrained in their budgets by the funds that they have available. The major contribution to funding is through economical activity. Part of the budget is for health care and the delivery of health care in turn has an effect on available funds. Under normal circumstances this will be a balancing loop. In the Canadian example, available funds are limited as a result of economical factors and therefore there is less available for health care. The problem is the effect of a second causality loop. Health care spending is popular and therefore has an effect on a politician's re-electability. Politics is about power (Ackoff, 1981:45) and promises are made during elections that lead to expectations from constituents. These demands are for more and better health care, which leads to increased cost and therefore turns on a reinforcing loop. In this case, the balance is disturbed by economical factors, which in turn affect the political system.
- Service providers create work that increases profits which affects cost. The idea that profits could be driven down through market forces by increasing the number of service providers, have had the opposite effect. This is a reinforcing loop.
- Hospital based health care leads to profit and therefore to more hospital based health care. Furthermore, profits are used to invest in high technology equipment and techniques that attract physicians and their patients, which creates more work and therefore more hospital care. High technology also increases patient demand for alternative expensive treatments and this in itself drives up cost. The latter is also affected by hospital profits. All these loops are reinforcing and jealously protected by vested interests.

- A fee-for-service remuneration system maximises profit, which in turn increases a demand for more profits[32]. The physician, as was shown, also affects the system in three other ways.

  i. The increase in the cost of medical education increases the physicians' debt at qualification, which decreases their profitability and increases the need for high earnings. This is a reinforcing loop. Educational cost is a separate problem that is influenced amongst other things by the educational system and economical factors.
  ii. There is a demand for responsibility from the health care profession as a result of its high profits. This leads to increased risk of litigation, higher malpractice insurance fees, decreased profit and therefore an incentive to recover profit in other ways. This is a reinforcing loop.
  iii. Lastly, medical administrators have an incentive for cost saving. The costs savings result in higher profitability (higher returns to investors and higher consultation fees). Efforts to decrease cost affect provider profit and an incentive is created to recover losses in other ways.

- In animal populations the population is kept stable by opposing balancing loops for birth rate and death rate (Kauffman, 1980:25). This also applies to human systems. In terms of the health care system, the aged have increased health needs, which has an effect on cost. The young's earnings supply the income to subsidise the aged during their generation. In the current health care system, this balance has been disturbed. The health care system contributes to longevity and at the same time intervenes with the birth rate through birth control. Factors that affect the ability to earn for the young, such as the economy, also indirectly affect the balance. This destabilisation of a stable system has had an effect on health care cost.
- In terms of the described system, cost is not only the symptom of the problem, but is at the same time a balancing loop. Funding for health care is not finite, and eventually the point will be reached where it is no longer possible to support profit at any level in the system. When this point is reached, some of the reinforcing causality loops will collapse and the whole system will become unstable. At the same time demands for wants will by necessity have to be replaced by needs and in all probability communal rather than individual needs.

4. Approaches to the problem

The cost problem has been approached in various ways, most of which have not taken a broad view of the problem. The next section will examine these approaches in terms of the preceding discussion.

4.1. Management science. The relative ineffectiveness of medical practice, or the perception thereof, has cost implications. It is assumed that by discovering a more accurate and "scientific" approach to medical process, cost may be controlled. The introduction of Total Quality Management (TQM) into the medical process to contain cost has been recommended in the literature (Berwick, 1991; Laffel and Blumenthal, 1989). The idea is that through better knowledge of the customer, moulding of the ideas of the organisation and increased control of the processes involved, the quality of care can be improved. The emphasis is on a organismic model of thinking. The customer is an input and medical

[32] Churchman asked the question what value of n satisfies the equation n = enough. In terms of human nature, the answer is n + 1 for whatever n is; in other words, we can never have enough of anything (Churchman, 1994).

process the processing of the customer through the system. The model is based upon a linear causality model and does not take account of the complexity of the problem.

Managed care is used by the business community to pool consumer purchasing groups in order to contract for prepaid health care packages. The emphasis of this approach is on cost and there are fears that the probable effect of such an approach could be a loss of quality (Holtgrewe, 1993; Levey and Hesse, 1985). The key constraint for physicians in this approach is a limitation on the autonomy of their decision making (Kongstvedt, 1989; Iglehart, 1992b; Gruca and Nath, 1994; Milstein et al. 1989) and the key constraint for patients a closed panel of physicians to select from. This is the fastest growing sector in health care in the USA. Cost saving is achieved through control of physician income and a shift from hospital to ambulatory care (Luft, 1978; Gruca and Nath, 1994; Milstein et al. 1989). Control is effected through various methods of medical audit (Milstein et al. 1989). However, in order to measure utilisation a mushrooming bureaucracy is needed that forms a balancing loop with efforts to save cost. In the USA expenditure for health care administration accounts for 19 to 24% of the total health care budget and his percentage is rising rapidly. The question is whether the modest saving from the elimination of unnecessary treatments is offset by the army of bureaucrats (Woolhandler and Himmelstein, 1991).

This option can have an effect on cost control. The question is whether the impressive early gains will be sustained in the long term (Teisberg and Porter, 1994). The experience with highly administered systems elsewhere seems to argue against this. Physicians fiercely resist this kind of system because of their loss of autonomy. Managers overcome this problem by importing physicians into the system, enabled by the over supply of physicians, which in turn causes further resentment.

4.2. Government. The state traditionally addresses the problem by setting up commissions of inquiry such as the Agency for Health Care Policy and Research (in 1989) in the USA. The object of this agency was to investigate how the databases of hospitals and health insurance organisations could be used to determine the efficiency of treatments. It is now accepted that the Patient Outcomes Research Teams (PORTS) set up to investigate the agreed upon topics have yielded no data of any significance. The reasons from a systems perspective are not difficult to see (Kingman, 1994).

Firstly, there is an underlying assumption that the databases are correct and complete. In my own experience nothing could be further from the truth. The information on claims forms, diagnoses, treatment given, etc., only reflects what the physicians want it to reflect. The fact is that one has to enter a diagnosis or code on a form in order to be reimbursed. These forms do not allow for multiple or complex diagnoses. Furthermore, the code determines the tariff of payment and there is a well known but unstated incentive to "pad" such codes (Milstein et al. 1989).

Secondly, there has been attempts by government to regulate or control the health care system in total. A recent example is the ANC Health Plan for South Africa (Anonymous, 1994b). To government the ideal form of control is to install its own bureaucracy to manage the system and in particular the collection and distribution of funding such as an NHS option (Benatar, 1985; De Beer and Broomberg, 1990). There is a belief that the solution to the cost problem is control of funding and service providers. This approach does not take into account the possible effects of such intervention on the system as a whole and also other systems with which it interacts. Not only will the health care system be changed irretrievably, but industries such as the pharmaceutical industry may disappear, which will influence employment, government revenue, and eventually health

care funding. This could lead to a reinforcing loop that will doom the health care system to mediocrity.

Historically there has been plans that had unforeseen effects on the system as a whole. For example, changes in the NHS in Britain lead to a reduced number of referrals to teaching hospitals, with subsequent damage to research and teaching (Mundell, 1992). In Zimbabwe, a primary care rural network was started but due to economic factors in other systems that were ignored, the system is on the verge of collapse (Logie, 1993). The Swedish NHS has failed and the primary care system is now being changed to a partially free market, free choice one again (Nilsson, 1993). In Germany, a new law was introduced to curb the prescription of drugs. Physicians will have to cover any excess if the drug budget is exceeded. As a result of this decision physicians are afraid to lose income and subsequently under prescribe. Not only are patients unhappy about this but pharmaceutical companies are suffering severe losses (Tuffs, 1993). They in turn put pressure on the government to rescind their decision in order to save their investments.

Regulation affects the ability of an organisation to adapt to a changing environment (Gruca and Nath, 1994). The regulations themselves often create external constraints that may either limit adaptation, or lead to misalignment with the environment. This makes survival impossible. Governmental regulation in an effort to reduce costs therefore has an important effect on the ability of the health care system to adapt and survive. For example, constraints introduced by government to regulate the treatment of Medicare patients in hospitals in the USA makes it impossible for these institutions to recover losses suffered by them. The loss in revenue is therefore shifted to private paying patients. This leads to a situation where private patients can no longer afford hospital care and hospitals with an insufficient number of privately funded patients can no longer survive and have to close down. The Medicare patient is then left without any hospital to attend at all. The government decision therefore created a reinforcing loop of circular causality that will damage the system as a whole.

4.3. The medical profession. Recommendations from the profession itself have been few and in general have been aimed at maintaining the status quo, in other words protect their profits (Scott and Shapiro, 1992).

4.4. Academia. The most active discipline as far as recommendations for health care changes is concerned, is social science. Some authors suggest that the right to health care is a fundamental issue, which ought to be the point of departure for any further discussion (Van Rensburg and Fourie, 1994; Van Rensburg and Fourie, 1993). This is a position of idealism with a problematic transition to be made to a pragmatic implimentable plan. This kind of thinking tends to be attractive to politicians who are the most likely decision makers to implement such ideas. Social science often concerns itself with the design of philosophical ideologies for political intervention, but not with the practical implications of such intervention.

4.5. The systems community. Efforts to improve health care have also come from the systems community (Ulrich, 1994b:372). These interventions have focused on the system as a whole and intervention has been aimed at improving the health of the population on a social level. The underlying assumption is a filtering down process, in other words, as the community gets healthier as a result of immunisation, better food, programs to stop smoking, etc., less health care will be needed and cost will be reduced. Such an assumption implies a world view suggesting that it is possible to eradicate illness (the deprivation model). In reality a change in environment usually means a change in illness profile. For example, in poor communities infectious diseases and malnutrition are an

important cause of illness. In advanced communities on the other hand, malignancies are a more important cause of illness because infectious causes of death have been curtailed. Furthermore, the "malnutrition" of excess leads to heart disease, kidney stones, etc. The idea to remove illness at a social level is a perfectly sensible approach but on a meta-level. The question is, is this the best way to address the problem and are there other potentially better ways? In other words, has the decision been made on the basis of a comprehensive enough inquiry and has sufficient assumption testing taken place?

All of the suggested solutions, except for the systems approach, have two factors on which they focus. Firstly, cost containment as an isolated issue and secondly control of the physician and patient as the perceived source for control of the cost distribution system. The approaches are therefore based upon a very restricted world view. This leads to problems of implementation and guarantee. Plans will not be implemented by patients and physicians who do not feel part of it, and goals planning with short-term objectives have long-term consequences that are often worse than the present situation.

i. Cost. The position of cost is linked to an assumption that cost is an environmental input into the health care system and that it can therefore be controlled free from environmental influences. The control of cost in the above mentioned models therefore lies outside the system. In this sense the world view is that of a mechanistic model, the boundary being between the health care system and its environment. The implication is that the basic health care system should not be directly involved in cost containment and the distribution of funds. Furthermore, the patient and physician should be controlled from the outside by government or administrators (Hillman et al. 1992; Frankel, 1991), who will develop a set of specifications according to which the system should perform. The implied loss of autonomy is not only the biggest fear of physicians as professionals, but also challenges the whole world view of their position in the system. This is fundamentally why physicians are opposing the suggested changes.

ii. Control. Managed care systems not only control the remuneration of physicians, but also their decision making ability. Preferred treatment protocols are prescribed as well as a medicines formulary[33] for what they are allowed to prescribe. These systems aim to enrol physicians as employees, which will mean that they can be controlled in a traditional way and which reduces their status to that of technicians. Control of the process of health care delivery leads to a rapid increase in bureaucracy and paperwork, increased cost and delays and a less efficient system (Grumet, 1989; Woolhandler and Himmelstein, 1991). The physician as an organ of the organisation has no avenue for participating in design and decision making which leads to an implementation problem. The underlying world view of these organisations is an organismic one.

    Furthermore, in such systems patients sacrifice their choice of physician and preferred treatment, which means in essence that their needs and wants are determined for them from outside the system. They therefore have no way of participating in the planning of decisions that affect them, in other words, they are marginalised.

In summary, this chapter investigated the question: Why is there a problem? Investigation revealed that although current attempts at problem solving are based upon an assumption of simple linear processes, the health care system is a complex social system composed of

[33] Medicines formulary: a limited list of drugs from which physicians are allowed to prescribed.

multiple interactive processes linked by circular causal interactions. Attempts to alter the system have not met with much success, since they do not take the complexity of such systems into consideration. It is the submission of this study that a change in the image that health care planners have about health care, could have a positive effect on future health care planning.

Furthermore, in a complex social system model of organisation, self-aligned participation by patients and physicians becomes possible, which increases the possibility that planned changes to the system will be implemented and in addition, learning about the system can take place. The possible outcomes of changes made to the system can also be more easily determined in a social system model of health care.

In the next chapter, further development of the argument of the study will take place by asking the question: How did the problem arise? This is done through a study of the historical development of the health care system.

CHAPTER 3

THE HISTORY OF THE PROBLEM

Historically, the health care system grew from a simple interaction between patients and physicians into a complex social system with multiple interactions. This was caused mostly by human intervention and the result has been unforeseen interactions, often with unsatisfactory consequences for the system as a whole. The problem is that the ability to intervene has not equalled the ability to control such interactions. The reason for this development is that increased knowledge has resulted in more complex models of illness and therefore treatment of a higher order of complexity. Such treatments necessitated the introduction of more professionals, both physicians and other health care workers, into the system and therefore an increase in the number of social interactions necessary to give medical treatments. The problem is that that both illness and medical process are still perceived as simple uncomplicated processes.

1. History of the patient-physician interaction (Chamberlain and Ogilvie, 1974:1; Singer, 1961)

For the purpose of this study, the history of medicine will be classified as follows:

1.1 The pre-scientific (ancient) era.
1.2 The scientific era
    1.2.1 Pre-renaissance.
    1.2.2 Post-renaissance.
1.3 Technological era.
1.4 Information era.

This classification follows an increase in complexity of the interaction between the different parts of the system. It also follows the history of Western philosophy.

1.1 PRE-SCIENTIFIC (ANCIENT) ERA

This era is arbitrarily taken to be the time before the rise of Greek philosophy with its subsequent influence on the development of western culture. It is also the time that 'primitive' medicine was practised, with an emphasis on intuition rather than empirical method. The practice of medicine associated with this era is essentially still being practised today in Africa and Asia. The implication is that although those systems have not escaped the influence of Western culture and Western medicine, it is still bound by the conventions that it originated from. It will be shown that these assumptions inevitably lead to a difference in both the perception and experience of the medical process by different cultures. It follows that it also has an important bearing on the patient-physician interaction.

1.1.1 The physician.

Historically, members of the community felt themselves called to heal and would then apply to and be accepted by the practitioners of the art of healing for training. (We still have to apply for and be selected for medical training today). This training would be by way of an apprenticeship which sometimes took many years and would mostly be practical. (Medical training is in effect still an apprenticeship, but the basic training follows the conventions of modern university training). Students would be instructed not only in the recognition of different illnesses, but also their causes. They would be taught how to find the ingredients for

making up medications to be administered for illnesses and how they should be prescribed. The secrets of the profession would therefore be handed down from teacher to pupil by way of an oral tradition, the origin of the treatments being from the forgotten past.

The practice of an apprenticeship was continued in western medicine by the guild of barber-surgeons (McWhinney, 1989:5)[34].

After the successful completion of the training, in some societies the new professionals would be publicly initiated into society so that everyone could recognise their standing in society as professionals. This ritual is still practised in modern medicine in the form of the oath that all medical students swear to in public at the time of their graduation. This is society's way of confirming the physician's position as a professional and expert.

In modern society, this position is codified by the physician's acceptance and registration with a medical council. Such councils are statutory bodies and serve as a barrier of entrance into the profession. They are appointed and supported by the state and control therefore rests with government

1.1.2 The practice.

The following discussion is based upon healing as practised as part of African culture. Traditional healers often formed societies or associations in their communities. It was accepted that these professionals would be reimbursed for the practice of their trade, but they were also trusted not to be exorbitant in their request for remuneration. According to Mbiti (Mbiti, 1971:166); '*These people have a language, symbolism, knowledge, skill, practice and what I may call 'office personality' of their own, which are not known or easily accessible to the ordinary person*'. This perception of the profession is still an underlying assumption for the interactions in modern health care systems. Patients have an image of a physician's "bedside manner", a metaphysical idea that is impossible to define. However, at the same time it is a sought after attribute and contributes to the professional image of the physician.

The fundamental distinguishing feature of this era is a 'holistic' approach. Illness was thought to be caused by the ill will of other people or by spirits through witchcraft or sorcery. To treat such an illness requires that the traditional healer not only diagnose and treat, but also deal with the spiritual aspect of the illness. Therefore in African villages, disease and misfortune are religious experiences and it requires a religious approach to deal with them. "*They have access to the force of nature and other forms of knowledge unknown or little known by the public*" (Mbiti, 1971:170). Therefore the public entrusts them with the duty of removing that which may harm the community. This mystical idea about physicians is the source of an extraordinary trust in medical practitioners, even today.

The traditional healers symbolise the hopes of society: hopes of good health, protection and security from evil forces, prosperity and good fortune and ritual cleansing when harm or impurities have been contracted. This understanding has become part of the collective subconscious in the west and has important implications for the way that modern patients perceive their diagnosis and treatment. The question is, does the modern physician still satisfy this need for protection? Another important observation is that of the interaction between physicians and the community that they served, in other words the close tie between

[34] The modern relics of the barber's pole (the line of blood from blood letting) and the habit of calling specialist surgeons mister originates from them. Physicians trained at universities and could therefore lay claim to the title doctor. Surgeons were apprenticed and belonged to a guild of barber-surgeons and therefore could not.

physicians and the community within which they practised. In modern times, this close interaction has broken down, with a subsequent loss of trust.

Traditional healers in Africa often are clothed in the regalia of their profession, such as animal skins, etc. This tradition is seen in modern medicine in the traditional white coat.

1.1.3 Ethics.

The concept that physicians should act ethically in relation to their community is a very old one. The first known code of conduct dates back to 2000 BC in Babylon (Code of Hammurabi). This code determined that physicians should determine remuneration according to the patient's social status and that they would be legally accountable for poor treatment (De Wet, 1991:42). The problem of a fair profit and accountability is therefore a very old one. Furthermore, the oath is the expression of the moral principles that reflect the major beliefs of the society that the physician serves (Pellegrino, 1976).

The concept of professionals as people in possession of special knowledge and skill stems from this time and is fundamental to many modern day assumptions, as will be shown later.

The ancient approach, although very much submerged in the subconscious of society (in the Jungian sense) is still very much central to the wants and expectations of patients in their interaction with the medical profession. After the ancient era, the development of the medical profession became a product of our Western culture, African and Eastern cultures having retained the essence of the ancient era. The fundamental approach of this time is more systemic than today but also spiritually weighted or intuitive. The concept of illness and the recommended treatment is based on a perception of the mind and the working of primitive reason and therefore a primitive image of illness.

1.2 SCIENTIFIC ERA

1.2.1 Pre-renaissance

During this period the ideas of the Greek philosophers started to influence the practice of medicine and by tradition the school of Hippocrates of Cos (460 - 377 BC) is usually credited for this. Hippocrates' contribution is not that of improved treatment or even the understanding of illness to the profession, but he introduced the concept of observation into the medical armamentarium[35]. In other words, the empirical observation of the illness (De Wet, 1991:42), its symptoms and signs, and its course, rather than a reliance on the assumption of vapours and humours as the cause of illness. The direct result of this is that this period signalled the start of increased empirical learning about illness and its causes. These schools continued throughout the middle ages (frequently under the auspices of the Church) and little changed until the start of the reformation. As a result of this approach medicine became less religious and more scientific. The cause of illness was no longer in the environment of the patient but came from the body. The physician subsequently became more aware of the body as a vessel containing illness. Presumably it also meant that although reason in the form of the rationalistic tradition was still an integral part of the concept of illness, empirical ideas started to permeate the practice of physicians through the process of observation and reflection of what the senses perceived. Today there has almost been an over correction in the sense that the body being treated is no longer part of the patient.

[35] The resources available to a person engaged in a task (Allen, 1992).

An important contribution to the art of medicine was made by the contact with the Moorish (Arabian) culture, whose medical expertise and knowledge at that point in time were further advanced than their Western counterpart.

Hippocrates also contributed to modern medicine his famous Oath. This document emphasises the individuality of the patient, and a commitment from physicians to help their patients and to do no harm to them. The latter is an important position which is virtually forgotten today.

1.2.2 Post-renaissance

During the renaissance the idea of empirical observation was further developed. In medicine, the work of Andreas Vesalius (ca 1543) acted as a stimulus for the rekindling of growth in the profession. He rewrote the dormant discipline of. anatomy based upon his observations of the anatomy of animals. This put into question many of the commonly held assumptions about disease processes believed in until then. The new found knowledge permeated the world, thanks to the discovery of the printing press. It now became possible for anyone who could read to study the published texts. One therefore no longer had to be apprenticed to gain access to knowledge, in this case medical knowledge. From now on, as in the case of religion with the translation and printing of the bible, lay people would be able to read and gain some knowledge about their illness. The expertise of physicians was no longer theirs and theirs alone. Patients started to interact with physicians if they had the opportunity to learn about their bodies and wanted to do so. Illness was no longer a religious experience or an interest of the community in the religious sense. However, all information disseminated in this way was not accurate, a problem that is still apparent in the lay press today. The problem with this is that misrepresentations, even unintentional ones, have the ability to shape the image of patients of illness, health and the health care system, and these images can sometimes have serious results.

Until now the physical examination depended on the unaided senses. The introduction of the stethoscope, thermometer, etc., as aids to diagnosis aided in the expansion of knowledge about disease and also the process of diagnosis and treatment during the eighteenth century (Chamberlain and Ogilvie, 1974:19). In addition, developments in the fields of chemistry, physics and astronomy, lead to the development of disciplines such as bacteriology, radiology, endocrinology, etc. They not only added to the knowledge of disease, but also to the process of diagnosis and treatment (McWhinney, 1989:6). From now on the traditional process of diagnosis and treatment was formulated in the form in which it essentially is still used today, namely:

- History taking.
- Physical examination.
  a) Observation.
  b) Palpation.
  c) Percussion.
  d) Auscultation.
- Differential diagnosis.
- Special examinations.
- Diagnosis.
- Treatment.

This was the era where the concept of the clinician was born. (literally *bedside art* (Allen, 1992)). They were people known for their ability to make an excellent diagnosis by the use of observation and deduction. Modern patients still have this image as part of their imagery of

how a physicians should be and act. The image of the professional was altered and expanded during this time. This is partly explained by the fact that in the seventeenth and eighteenth centuries physicians were a small group of learned individuals educated in a few universities (McWhinney, 1989:4). They practised mainly in towns amongst the rich and influential, a practice that is still followed today. One of the fundamental problems of the health care system still is a preponderance of practitioners in cities and wealthier areas with a relative shortage amongst poor and rural communities.

The empirical knowledge of medicine now grew exponentially. It was the time when observation of patients and their problems and the interpretation thereof came to the fore. Their rapidly changing environment largely drove the growth and change in the medical profession. One can ask the question whether the knowledge of medicine as a discipline grew by itself or whether knowledge grew as a result of growth in the related disciplines such as chemistry, biochemistry, anatomy, etc., and medicine just borrowed from it. This point may be more than merely of academic interest.

According to Kuhn (Kuhn, 1962:19), the principal reason for the existence of the professions is social need. His method, the examination of science by its historical data, recognises the development of mature science by the successive transition from one paradigm via revolution to another. He postulates that a science is pre-scientific if it merely gathers facts and in the absence of an implicit body of beliefs in the discipline has to have one supplied by another discipline. By this definition medicine is a pre-scientific discipline and not a science in the sense that Kuhn defined it. In terms of this definition, medicine is not a discipline with a clear paradigm. A review of the published literature is more that of the reporting of factual data than speculation, which by Kuhn's definition proves this point. This has important implications for the way that the practitioners of this craft form their belief systems about the body of work that they use to practise with. The modern medical fraternity believes that it is a science and that it is practised scientifically. If this is not the case as is suggested here, then it has important implications for the belief systems that professionals in this discipline use.

Physicians became busier with their new found diagnostic tools and the discoveries in botany, chemistry, etc., contributed to the complexity of the pharmaceutical field. The potions to be used were handed over to the chemist to prepare and distribute. Until now the ill have been treated at home where patients were visited and treated by physicians and their assistants making 'house calls'. (The concept of home care is still an important issue in health care today). During this period the profession of the professional nurse was started. Patients were now removed from their homes to a hospital where they were nursed under the supervision of the physician. The nursing profession became of age through the efforts of Florence Nightingale during the Crimean War. These two additions, the chemist and the nurse, were the start of a rapidly increasing number of interactions and subsequently complexity in the health care environment in which the patient-physician interaction takes place. The original interaction involved two people, the physician and the patient, and an embracing environment. Now the interaction involved four groups of people: the physician, the patient, the hospital system; including nursing care, and the pharmacist. The nature of group interaction differs significantly from that of individual interaction. (See Bion, 1991). The significant observation to be made though is that physicians were still by tradition the directors of the orchestra and therefore had to be "in charge" and make the decisions. This concept of being in charge is still an important part of the modern image that both patients and physicians have of medical practitioners. In addition, as a result of this, it is believed that they are responsible for all the actions and interactions that takes place in the "orchestra".

1.3 TECHNOLOGICAL ERA

This period can roughly be taken to follow the industrial revolution. People now started to substitute machines to do work for them (Ackoff, 1981:11). In medicine this period saw the introduction of highly sophisticated equipment to aid in diagnosis and treatment. It was the time of advances such as X-rays, anaesthetics, insulin, etc. The introduction of these technologies had a profound and systemic impact that contribute to the current crisis in the profession. This period resulted in an explosion of knowledge. Not only did more knowledge become available to the physician, but many previously unheard of, sophisticated treatments became possible. This by necessity impacted on the wants of patients. In many instances discoveries were driven by the wants of society and not their needs. This resulted in strains not only on delivery systems and costs, but (some may say more importantly) traditional values and ethical systems of society and medicine were put under increasing strain (De Wet, 1991:3; Claassen and Verschoor, 1992:2).

The knowledge load became such that individual physicians could not hope to know everything about their discipline any longer (Grant and Dixon, 1987). This lead to the introduction of the specialist into the system. Paediatrics was the first separately recognised discipline in the USA in 1892 and the major disciplines all came into existence during the first part of the twentieth century. Further fragmentation into sub-specialities started in the 1950's and by 1989 there were 23 speciality and 51 sub-speciality boards in the USA.

Associated with this period is a loss of understanding by medical practitioners of the values of the society that they serve. Consequently, physicians have lost the ability to make moral and value decisions for their patients (Pellegrino, 1976; Callahan, 1980).

The introduction of machinery made mass production of medicines possible. These were now made and manufactured by businesses, bound by business interests and ethics, and the traditional chemist in time became no more than a distributor of drugs. As such they lost their status as professionals, which by definition they no longer are. Most pharmaceutical companies are driven by the need to show a profit on their investments (Taber, 1995). This has important ethical and moral implications. The success of a drug depends more on effective marketing than on research (Editorial, 1993). Sales are often increased by widening the indications for the use of a drug. Most pharmaceutical research is in areas such as lipid lowering drugs and psychiatric drugs, mainly because new discoveries in these areas are extremely lucrative.

Similarly, the hospital system developed to the extent that professional managers had to be found, which spawned an accompanying bureaucracy. Nurses became employees of this system, their first loyalty being to the hand that feeds them and the patient's interests today has consequently become of secondary interest. Nurses now strike for better wages as common workers, the interests of the patient being secondary to their and the trade union's aims.

Until the 1930's, patients were themselves responsible for payment of their health care bills (Samuelson, 1993). Due to the increasing number of players, complexity and increasing costs, an increasing number of patients could no longer afford to do so. This lead to the introduction of medical insurance. The object of this was that patients would deposit funds with administrators as long as they were healthy and could then draw on this in times of need. Administrators negotiated payment with the different service providers, usually at a discounted tariff in return for guaranteed payment. This system rapidly grew to include virtually every member of society who could afford to join. Remuneration therefore no longer was an aspect of treatment to be considered and discussed between patient and physician, but

became a negotiation between physician and administrator. Both service providers and patients became less aware of cost. To the latter health care became a right in return for their insurance contribution. Administrators are essentially business people and their aim is profitability. This is reflected in the way in which patient funds are administered. In South Africa, and probably many other countries of the world, the relationship between administrator and physician rapidly declined to one of hostility and mistrust. The reason is that both are competing for a limited resource, namely health care funding.

Lastly, modern technology increased the life expectancy of the population. People want to live longer, but the longer they live the more likely they are to develop chronic illnesses, and modern society can no longer afford to care for the ageing population it had helped create.

1.4 INFORMATION ERA

We are now in the transition to the information era (Toffler, 1990;[36] Ackoff, 1981:13). The body of knowledge available in even a single discipline like medicine is mind-boggling. It is also growing at an exponential rate and much of this knowledge is relevant for only a limited period of time. The challenge of this era will be the dissemination and constructive use of knowledge. In terms of the discussion thus far, the only solution to this problem is a learning organisation. In other words, the solution lies in individuals starting to interact in formal social groups, sharing information and skills. There will be a survival advantage to those groups which can adapt and learn in our rapidly changing modern environment in a co-evolutionary manner. Those individuals who hope to go it alone will, like the boy facing the leaking dyke, find themselves with all their fingers and toes plugging holes with new ones forming all the time.

2. World view

The development of the health care system lead to the following world view of the health care system that is dominant in westernised countries.

- A large part of medical diagnosis and treatment is still intuitive. Although the medical student is trained within a scientific paradigm, when in practice this knowledge is often ignored and decisions are made intuitively "in the old way". Such decisions are then motivated as being "in my experience", which is arbitrary and untested and in a sense resembles ancient shamanism.
- Medicine is a calling (*a vocation* (Allen, 1992)). Although the selection of the medical student is different from that of the more primitive healer, the idea that society (or the university as representative of society) should select those candidates most suitable for the profession still persists. It is debatable whether this selection process is suitable for the purpose of modern society, since the criteria used are based on intellectual achievement and socio-economic ability, in other words the trappings of the technological era. The question arises whether the medical practitioners that are trained by the educational system are equipped to deal with the modern health care system in which they will find themselves. More so, are they the physicians that society needs? The concept of a calling also prohibits physicians to act in any way that will harm their clients, which therefore means that they may not withhold their expertise (strike), etc. This restriction is enshrined in law in many countries.

[36] According to Toffler, people get power through the control of force (violence or threat of violence), money or knowledge. We are now entering the era where knowledge will mean power.

- Training takes place by way of an apprenticeship. As shown earlier, this is still true of medicine and in particular the surgical disciplines, but the basic primary care training more accurately reflects the ideals of the technological era.
- In primitive societies the secrets of the medicine men were guarded. This is still true today where the knowledge of medicine is shrouded in unpronounceable latin terms (Toffler, 1990:7). This reinforces the image of the professional.
- Medical practitioners are still initiated into society during the taking of the Oath. This ceremony takes place in the presence of members of the community and once this is completed the community confers on them the status of professionals. This term and its implications will be discussed in the next chapter.
- Medical practitioners still form societies closed to laity like their earlier ancestors.
- Physicians have a special relationship of trust with the community that they serve. This relationship has come under severe strain in recent years for a number of reasons, which will be discussed under the patient-physician interaction.
- Physicians are professionals and therefore individuals who function on their own and are presumed to be experts and always in charge (linear causality).

This world view of the patient-physician interaction has lead to some unresolved tensions, mostly as a result of a changing environment to which the world view has not adapted.

- There is a tension between the intuitive, mystic approach and the empirical, scientific, specialised, high technology approach. This is essentially a tension between the ancient shamanistic approach and the Greek philosophical tradition (precision and knowledge).
- There is a tension between a world view of health care as a holistic communal problem and a focus on illness as an entity (reductionism).
- There is an opposition between the belief in the medical community that their profession is a science and the reality that much of the profession is borrowed from its environment.
- An increase in knowledge has lead to the necessity of specialisation and super-specialisation that has lead to an alienation with the patient. The reason is that the community of physicians have not been able to make the transition to a social system that is sharing a common world view.
- There is a tension between a view of medicine as an ethical profession and the intrusion of business and business ethics on the other hand. This is the same tension that exists between commercialisation and any other profession[37]. Business is about satisfying customer demands and hence the customer is always right. In terms of the definition of a professional, the professions cannot be businesses because of the inherent incompatibility in performance criteria.
- The result of the tensions is that the medical profession is faced with a total collapse of their ethical base and an inability to rectify it (a village common situation). There is also an increased alienation between physicians as representatives of their community and patients (Levey and Hesse, 1985).
- There is an alienation between physicians amongst themselves and in particular between generalists and specialists.
- There is a tension between the medical needs and wants of patients.
- The concept of physicians as professionals is in conflict with what they can deliver. By definition, the physician is a professional[38] expert who has been taught from a

[37] J.P. Strümpfer: personal communication.

[38] A professional: *a person belonging to a vocation or calling.* An expert: *someone having special knowledge or skill in a subject.* Accordingly, the definition of a professional will be: *a person who is called, and has special knowledge or skill.*

body of knowledge to assist patients in restoring a perceived physical or mental dysfunction (Allen, 1992). This means in effect that physicians put to the disposal of their patients (clients), special knowledge and skills in return for remuneration. To do so, tools will be used from the larger medical system to assist them in diagnosis and treatment.

In summary, in this chapter it has been shown how the health care system grew from a simple one on one interaction into a complex social system. At the same time, the image of the professional is still that of the original simple system and is therefore out of step with reality. It has also been shown that for the health care system to successfully make the transition to the information age, it will have to function as a complex social system. The success of such a system will be determined by its ability to form shared images (particularly as regards patients and physicians), the ability of patients and physicians, and physicians amongst themselves, to interact purposefully as a social system, and the ability of such a system to exhibit group learning. At present, health care is a non-aligned complex social system.

The finding of the study until now, has been to identify the health care system as a complex social system, but with an underlying world view of illness and process based upon a simplistic linear model. This is therefore the dilemma of medicine as it is being practised today. This can be illustrated most starkly in the simplest interaction, namely the patient-physician interaction. Furthermore, in terms of this proposition, this is the level where intervention could potentially have the biggest and most beneficial effect upon the system as a whole. In the next chapter, this interaction will be analysed against the argument developed until now.

CHAPTER 4

THE PATIENT-PHYSICIAN SYSTEM

The patient-physician interaction is the first and simplest interaction of the health care system. The purpose of this interaction is to decide upon a course of action to solve the patient's problem. This chapter will explore the patient-physician interaction as the first level of medical process. Although nominally only two people are involved in the interaction, it is one of high complexity. The beliefs and expectations that patients and physicians have, significantly increase the number of permutations to be considered in decision making. Added to this is the complexity of illness processes itself (knowledge). Furthermore, the efficiency with which knowledge available to the system is utilised is a function of the efficiency of the processes and interactions in the system. The decisions that physicians and patients make ultimately determine how the health care system will be utilised to address the patient's problem. The eventual measure of this is the cost to the system. Therefore, the interaction between patient and physician sets into motion a train of events that consists of the interaction between a number of players in a complex social system. It is therefore proposed that the system can be improved, with an ultimate saving in cost, by improving the decision making process. This process can be improved by testing and changing the beliefs of patients and physicians, and by the improved utilisation of the available knowledge in the system.

The discussion will be based upon the assumption that:

- Health care is in the first instance the responsibility of patients. They may be assisted to achieve this by physicians.
- The consultation process is influenced by the world views of illness and of physicians as professionals. Patients and physicians have their own versions of these world views.
- Diagnosis ought to be a learning cycle, rather than the current linear process.
- The diagnostic cycle is an analytical process based upon the manipulation of knowledge and experience. It suffers from the same constraints of knowledge as other scientific disciplines.
- Treatment is influenced by the decision making process as well as the concept of control assumed.

1. The patient-physician system

For the purpose of this text, the patient-physician system will be defined as a system where a person (patient) consults[39] a professional (physician) about a perceived change in his or her physical or mental well-being, for the purpose of obtaining reassurance or to have the change restored or altered to his or her satisfaction. The components of this system are: the patient, physician (family practitioner and specialist), pharmacist, hospital system and administrator, all of whom are part of the larger health care system. In reality the patient-physician system cannot be seen in isolation, since it is affected by input from the larger health care system, which in turn is influenced and affected by the larger social system. The boundary selected here is therefore arbitrary in order to create a snapshot in time for analysis and discussion.

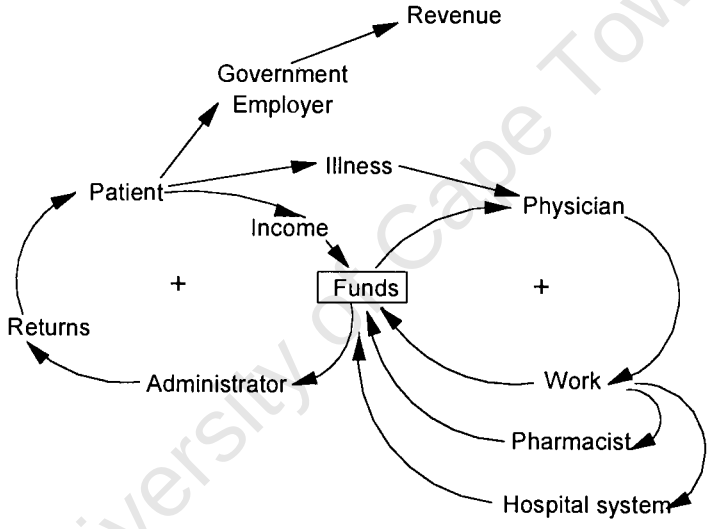
What is understood by the term "health"? An often quoted definition is: *the complete physical and mental well-being of all humans and not merely the absence of disease* (World

[39] Consult: *to seek information or advice.*

Health Organisation definition (Ulrich, 1994b:379; Anonymous, 1965). This definition is vague and consequently does not stand up to rigorous examination. According to the Concise Oxford Dictionary (Allen, 1992), health is a state of being well in body or mind, and care a thing to be done or seen to. Health care would therefore be a state of well-being of body and mind that must be done or seen to. Another more comprehensive definition, is Henrik Blum's: *health care is a state of being in which the individual does the best with the capacities he has, and acts in ways that maximise his capacities* (Ulrich, 1994b:379). This definition emphasises purpose and personal responsibility and will be the operative definition in this text.

Who must see to it? In terms of a social system model and Blum's definition, it is the responsibility of individuals themselves to seek the well-being of their own bodies and minds[40]. To achieve this they may be assisted by health care workers such as physicians and also by other elements in the individual's social environment (politicians, civil servants, etc.). The focus of this study is the interaction with the physician.

The fundamental interactions of the system (illustrated in diagram 4) are:



The patient-physician system
Diagram 4

- The physician makes special knowledge and skills available to the patient in return for remuneration (Kass, 1983).
- The patient invests funds during periods of health with administrators who manage the funds and reimburse relevant parts of the health care system on behalf of the patient in times of illness. In return they are allowed a management fee (Teisberg and Porter, 1994).
- Specialists have knowledge and skills of a higher order than the family practitioner (McWhinney, 1989:21)[41].

[40] The difference between patients' rights as opposed to their responsibility is often confused (De Wet, 1991:24). There is also a difference between equity and equality (Ackoff, 1981:33).
[41] The implication of this in the current health care system is that they are used by family practitioners as a resource. This kind of approach is inefficient in terms of a learning organisation model.

- Hospitals make facilities and equipment available to physicians, which enable them to practise their knowledge and skills.
- Pharmacists stock medication, which physicians prescribe to patients.
- Specialists, hospitals and pharmacists are remunerated for their service by health fund administrators.

In terms of process, two interactions can be identified as problematic in the present system. Firstly, there has been a breakdown in communication between physicians and administrators, each of whom see each the other as enemies. It was shown in chapter 2 that the reason for this is the competition for health care funding, which is a limited resource. Physicians respond to the threat by attacking the patient. This can be done through over servicing, unnecessary procedures, padding of accounts, etc., in other words by increasing the amount of work done. Administrators are powerless to prevent this and have to charge ever increasing contributions from patients to cover their escalating costs. This is a village common situation due to a limited resource, namely health care funds.

The problem is that at the same time the physician's actions also fuel the hospital and pharmaceutical side of the system (unintentionally). This accelerates the funding loop, which is a reinforcing loop, until patients find themselves in a situation where they can no longer afford health care. They then put pressure on their representatives in government or their employers who feel obliged to intervene. This in turn puts pressure on government and company revenue. Companies who cannot control the health care costs of their employees lose their competitive edge and cannot compete in world markets (Levinsky, 1984a). The actions of physicians therefore affect not only the health care system directly, but other associated systems indirectly as well[42]. The only way to prevent these two reinforcing loops from running together, is by implementing a shared idea of the patient-physician system, in other words by self-aligned participation by the patient, physician and administrator in the health care system.

Secondly, there has been a breakdown in communication between FP's and specialists. This leads to double prescribing, the repeating of expensive tests, lost time, etc., that also fuels the cost in the system as a whole. This happens because the diagnostic-treatment system has to be cycled through twice instead of once. This creates a problem of inefficiency in the use of knowledge that will be discussed later.

2. The consultation system

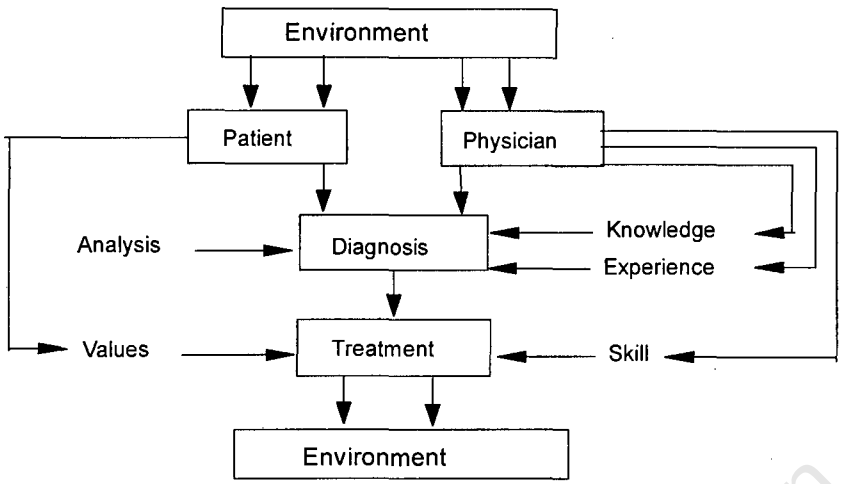
The consultation system is the axis around which the patient-physician interaction revolves (see diagram 5). Patients use this system to resolve their illnesses. The purpose of physicians as professionals is to bring their knowledge and experience to bear on the problem in an analytical way, in order to find a reasonable explanation for the problem (diagnosis). They use their skills to put their theories to test by way of treatment. Once the problem has been satisfactorily resolved, both patient and physician return to their respective environments and the interaction is concluded.

The patient-physician interaction basically involves three processes.

i. The consultation, which is the interaction between patient and physician.
ii. The process of diagnosis.

[42] See also the discussion in chapter 2 about this interaction and its effects on the whole health care system

iii. Treatment. (Diagnosis and treatment are traditionally considered to be the responsibility of the physician).



The patient-physician interaction
Diagram 5

2.1 THE CONSULTATION

This involves the patient, the physician and the patient's illness. The wants and needs of both patients and physicians contribute significantly to the complexity and outcome of decision making. These are often not made explicit and are usually difficult to quantify. These images will be the topic of discussion in the next two subsections.

2.1.1 The patient

A person receiving, or registered to receive medical treatment (Allen, 1992).

Both the illness or problem and the experience of it, is a function of the environment in which patients live. The patient's problem and the expected experience of the consultation can be the result of an expectation, a want, or a need. Illness will be discussed separately for the sake of clarity and not because it can be separated from the consultation. Illness in this discussion will be assumed to be an expression of the patient's wants or needs.

A. Expectations.

Expectations are shaped by the personality of patients and their previous experience of similar problems (what they have learnt). These expectations lead to images (mental models) of health care that determine the demands that patients make on the health care system (see the discussion in chapter 2).

- Patients have a perception or expectation (image) of their problem and its possible resolution. Such images come from personal experience as well as the reported experience of other people. They may have experience of someone they know who has suffered from a similar complaint before. Such an experience has a powerful influence on expectations about their own problem and its possible resolution.

  The influence of the 'lay press' in shaping perceptions about illness and the medical profession cannot be underestimated (De Wet, 1991:9). Often patients have read about a

specific condition such as prostatic cancer and by the do-it-yourself questionnaire attached, found symptoms that they imagine to be the result of this condition. The fear of cancer is then the reason for the consultation. Images are often clouded by the fact that reports in the lay press frequently are an incorrect representation or misrepresentation of reality. The question of the value system and the subsequent responsibility of the printed press is an important systems question in this regard.

- Cultural expectations play an important role in forming an image of disease, particularly in a culturally diverse country such as South Africa. For example, young black men sometimes complain of impotence. Further questioning then reveals that they are unable to produce multiple performances in one night. To the mind trained in medicine within our western cultural framework this is nonsensical, but within a framework of the African culture, it is not (Mbiti, 1971:146). This diversity of cultural attitude creates problems in the medical system as we know it. Firstly, we are not trained to deal with multi-culturality, but more importantly, our medical system as we know it is the product of our Western cultural heritage (Vickers, 1969). This means that physicians trained in this paradigm are unable to deal with this kind of complexity in terms of the environment within which it has meaning.

  The question then is, should this system be changed to include these expectations and if so, how? Can we attempt to integrate African, Eastern and Western systems into a medical community as we know it. For example, it is important in African culture to prove your ability to procreate. Unmarried patients will therefore often be referred for help. The problem now is that current health care funding does not support this kind of treatment. More so, it does not support this treatment in unmarried couples. The patient can now have the necessary treatment in a private capacity, but very few can afford it. The reason such treatment is not supported, is that it is considered to be a want and therefore not necessary. However, from a cultural point of view it is important that the patient should be helped, because they may find themselves ineligible for marriage or even relationships in their own cultural environment. This leads to stress and other related problems. There is of course an ethical question as well. Should we contribute to the population problem that the world suffers from and also possibly to that of homeless children. Cultural expectations therefore introduce great complexity into the consultation.

  The cultural problem has another aspect. In Europe, homeopathy, osteopathy and aromatherapy are popular alternative treatments and of course in the east, treatments such as acupuncture, etc. These "doctors" can now practise legally in this country and may solicit referrals from medical colleagues. The dilemma is that by far the majority of these treatments that have been tested in terms of the Western scientific tradition have failed that test. For example, phytotherapy (herbal treatment) for benign enlargement of the prostate is as good as no treatment at all (Fitzpatrick et al. 1991). Furthermore, most physicians have experience of cases treated by alternative medicine that went horribly wrong. These schools, rightfully so, point to their success in treating cases in which Western medicine has failed patients, the dilemma being why did the treatment work. It may be that the reason is the well-known placebo effect, or just simply an alteration of lifestyle to a more healthy one. The fundamental difference between Western style medicine and alternative treatments, is in the rigour of diagnosis. Therefore, the question may not be why alternative treatments work, but can traditional healers diagnose accurately? If not, they will contribute to the cost problem through deferred treatment. The point is that such healers could potentially be accommodated in the health care system, but that would entail a change of world view about the system.

Finally, the importance of culture is the fact that it represents the larger social system within which patients and their problem ought to be seen and which includes both patients and the medical system. It is widely accepted in the medical profession that medical treatment, primary health care, high technology medicine, etc., contribute very little towards a healthy population. The biggest gain comes from adjusting the social system. By creating employment, a person can afford a proper home, food, sewerage, etc. and this indirectly has an impact on health (Cowley, 1993).

- Patients have expectations of the physician that they consult, in other words an image of the physician as they perceive it. The image of learned professions is based upon an assumption of knowledge and skill. *"Patients expect to benefit from medical care. They consult a doctor because of his skill. They trust him to exercise his knowledge and skill to the best of his ability, and they assume that he will take all reasonable steps to ensure a favourable outcome"*(McIntyre and Popper, 1983:1920). Physicians derive their authority from their assumed knowledge and skill, the belief being based upon a linear causality concept, in other words, it assumes that physicians are in full control of the situation. It has been shown in chapter 1 that control is only feasible in a simple deterministic system, which medicine is not. This issue will be raised again in the discussion of the image that physicians have of themselves. The question is, what knowledge and skills do physicians have to justify this image?

Another assumption, based upon the same model, is that physicians as professionals all have an equal amount of knowledge and skill. Therefore, it does not matter who you consult, the outcome will invariably be the same. This is a mistaken belief and may have potentially serious consequences. Furthermore, it leads to the inefficient use of resources and therefore has cost implications. It may be that this assumption is fundamental to the fact that physicians are selected by patients on grounds other than knowledge and skill.

The image or expectation that patients have of physicians influence their selection of service provider. For example, patients tend to consult physicians on the basis of a word-of-mouth advice, either by a lay person (friend or acquaintance), or another physician (referring physician). They will select specific physicians because of their "good bedside manner" or "because they are wonderful with children", but rarely because they are known to be competent or well qualified. I have often been told myself that patients expected an older physician, since "specialists are usually older and more experienced". Such an image may lead patients to question the validity of an opinion, because of a presumed lack of experience.

Table 1 : Selection of Family Practitioners (Sherag)

Good with children	17%
House calls and available after hours	14%
Friendly	11%
Has enough time for patient	9%
Knows what he is talking about	9%
Trust in his judgement	8%
Accurate diagnosis	6%
Interested in the patient	6%
Listens to your problems	6%
Reasonable rates	6%
Makes me feel comfortable	3%
Refers when necessary	3%

A market research conducted for Sherag in 1992 (Anonymous, 1992) showed that patients selected practitioners for the reasons indicated in table 1. The interpretation of the results depends on whether the right questions were asked, how they were asked, etc. However, in spite of such reservations, conclusions can be drawn from the data. The table suggests that the selection of physicians is based, as suggested above, on imponderables such as good with children, available after hours, etc., and there appears to be an implicit assumption that all physicians are knowledgeable and skilful. On the other hand, how do patients know if the diagnosis has been accurate and the standard of care sufficient, other than measured by their own expectations of the outcome (Teisberg and Porter, 1994). Even medical practitioners have difficulty in judging the competence of colleagues in different disciplines from their own.

- Patients have an expectation of what treatment to expect. For example, they may believe that there is a cure available for the common cold, although medical science has not managed to secure one yet. They may come with a suitcase in hand, in case they will be admitted for treatment, because they expect hospital treatment or surgery. The problem is that sometimes physicians are influenced in their decision making by patient expectations. This has cost implications.

- Patients (at least some of them!) have an expectation of an eventual remuneration for the consultation. As shown earlier, in early history patients expected to pay directly and promptly for the service rendered. It was also shown that the modern position is that patients have contributed to medical insurance and expect this source to take care of any financial implications of the visit. This leads to an expectation that the service is a right and free and that they can expect their expectations of the visit to be met (Anonymous, 1991). This is a fundamental problem and weakness in any "free" medical care system such as NHS (Anonymous, 1991). Many patients are unhappy if their complaint is not covered by insurance, the blame usually being placed on the physician who is considered to be the cause and culprit.

B. The illness

Of fundamental importance is the world view (image) of illness within which the consultation takes place. In the present health care paradigm, illness is viewed in a reductionist way, in other words a linear cause and effect model. The emphasis is therefore on the perceived cause and the eradication of the cause, the process seen as the one necessarily following the other. A competing world view is a systemic view, where the illness is seen in terms of the environment in which it happened and within a systems dynamics model. Such an approach would be more in keeping with the complexity of physiological processes and their disturbance in the form of illnesses.

The deprivation model of illness is a linear model that assumes that illness can be removed by removing deprivation and poverty (Charlton, 1994). The redistribution of wealth and income is therefore seen as sufficient to remove illness as a problem from society. This model has been used in approaches to health care both by systems thinkers (Anonymous, 1994b) and non-systems thinkers, as shown in chapter 2.

In a circular causality model with multiple feedback loops, there are many factors that are necessary and that interact to cause an illness, even though a single symptom may be prominent and the focus of concern. Differences in illnesses are only in the complexity (number of co-producers) of the interactions leading to illness (product). Even a simple problem such as a cut may have a number of co-producers. Why was the knife not in its normal place? What interaction with the parent lead the child to ignore the warning not to play with the knife, etc. In the case of a cancer, the complexity is such that we have a very

limited understanding of why the growth occurs. This discussion has an important point. A comprehensive treatment will attempt to address as many of the co-producers of the illness as possible, even though the immediate focus may be on the problem itself. If this is not possible, there should be an awareness of the fact that the problem is not dealt with in total and in many cases not at all. The focus then will be on the symptom of the illness, which in effect is the current Western illness paradigm.

Furthermore, the concept of causality has an important influence on medical research and consequently medical knowledge. It has an even more important influence on the belief of physicians that they are in control of the diagnosis and treatment. A linear concept of causality is the cornerstone of the managed care medical audit system. These issues will be discussed later.

- The consultation may be the result of the wants or needs of patients. For example, a patient may want to have a small upturned nose. Having it is not a necessity, however the current health care system makes it possible for this want to be satisfied. Modern technology largely focuses on addressing health wants, for example the current shift towards keyhole (laparascopic) surgery. Patients do not want incision scars and modern equipment makes that possible through improved technology. However, there is no proof that such technology is cost effective, in other words wants in this case leads to increased cost. The problem is therefore: patient wants, technological discoveries to support wants, increased work and therefore increased cost (see diagram 3)

  On the other hand, the patient may suffer from tuberculosis or malnutrition, the treatment of which is a need that has to be satisfied. The distinction between wants and needs is not always easily discernible.

- The illness itself may be the result of the patient's environment. An example is an industrial accident or industrial illness, such as pneumoconiosis. Tuberculosis and meningitis are conditions associated with crowding and therefore poor socio-economic conditions. Post-traumatic stress disorder is likely to be more frequent in times of war and civil violence. Attention to the social environment therefore has an important role in reducing illnesses caused by the environment, which in turn may have a positive effect on cost.

- The historical background of a society as part of its social environment can be a co-producer of illness. For example, the Afrikaner has an inordinately high incidence of familial hypercholesterolenemia and subsequently coronary heart disease. This is the result of intermarriage, in this case in its widest sense. The fact is that a genealogical investigation quickly reveals the fact that the Afrikaner originates from a very small genetic pool.

- Some illnesses are self-inflicted. The common example is smoking, which is now generally accepted as being dangerous to health. In spite of this, a surprising number of people still persist with it. Another example is AIDS, which can potentially be eradicated by simple social measures. A study amongst young people in a number of first world countries have indicated that the majority of them are aware of this illness and measures for protection against it. And yet, only a small percentage are actually heeding this advice (Anonymous, 1994a). Self-inflicted illness as a problem affects cost.

- Some patients have illness built into their life scripts[43]. To them the health care system is an emotional support system. Mental models are therefore influenced by a personal attitude to illness. These are the patients that will often move from physician to physician if they are not satisfied that the advice that they are given fits the model of what they expect. The problem is that in these cases psychological intervention to remove this script will often leave them with no script at all and create a new even more complex problem. It is also true that the current system of payment and support makes it highly undesirable for these patients to play out their scripts, yet at the same time the structure of it allows them to do so. In terms of causality, the personal script leads to illness, which reinforces the script through a reinforcing loop. The problem is that the illness at the same time affects cost loops.

- Sometimes, the perception of symptoms is quite obvious, a broken arm is bent in an unnatural angle or a strange lump is in an unusual place. Many symptoms however, are based purely on the subjective appreciation of the patients themselves. How does one understand pain or impotence? We try vainly to measure such complaints, but in the end they have a metaphysical component that cannot be encapsulated into a scientific truth or law. This is the problem of image formation and the transfer of such images to other people.

- People diagnosed as being ill by the physician occupy a special role in society namely the illness role. This role accords them with certain obligations and privileges. For example, they are exempted from social obligations and are not held responsible for their incapacity (McWhinney, 1989:29). The way that patients experience illness and accept their role is a personal one determined by individual personality. Once they accept the role, they are obliged to seek professional help and also to make every effort to get better. Some patients will fail to consult, even when they have a serious problem and others will consult for minor problems that could have been solved with self-care. The reason for this is that the environment of patients often shapes their decision. For example, failure to consult may be caused by unemployment caused by illness, religious beliefs, lower socio-economic class, etc.

In summary, patients have a complex world view in place that is the product of the interaction between their environment and their personality. It creates expectations about the consultation and the outcome of their treatment, and therefore affects the system in terms of cost. Changing this world view could markedly influence the system, which could indirectly have a beneficial affect on the system as a whole and therefore cost. Important aspects of this world view are:

- The concept of illness and health care.
- The image of the physician as professional. This includes the ideas of authority, control and knowledge associated with this position.
- The complexity that the world view adds to the consultation process.
- The expectations (demands) of the health care system that the world view creates.

Another way of looking at the wants-needs dilemma is in terms of purpose. Needs have to be satisfied to ensure survival and physicians are the means for achieving this. However, wants have an ethical component that questions the desirability of many patient expectations. Therefore, a world view that has the ability to address purpose, has the potential to influence the system.

[43] A script is an ongoing program developed in early childhood under parental influence, which directs the individual's behaviour in the most important aspects of his life (Berne, 1987:418).

2.1.2 The physician

A person legally qualified to practise medicine (Allen, 1992).

As in the case of the patients, physicians are the product of their environment. Their mental model of the interaction is created in a similar fashion to that of patients and they also have expectations, wants, and needs that are part of the consultation. These images add substantially to the complexity of the interaction.

- Possibly the most important part of the model is the image that physicians have of themselves as professionals. Physicians tend to take on the image that the interaction which society demands. It may be that in some cases physicians take on the role that they assume society wants of them, for example surgeons may take on the role of a "cutter". Take note here that it is not what society ought to get from them, in other words what they were taught during their training. It is a peculiar fact that once physicians qualify, they ignore much of what they have been taught. They tend to resort to practising the craft in a piecemeal way based upon personal perceptions (images) of what they ought to do. The most fascinating aspect of this change is the way that they motivate their actions. This leads to a perception of medicine as being "a medley of science, magic, and inspirational guesswork" (Boulding, 1987:30) when the profession is observed from the outside. The problem is not with the process, but in the way that physicians as professionals act.

  A study is quoted in New Scientist (Kingman, 1994), where researchers wanted to test a specific treatment for adult respiratory distress syndrome. At the start of the study it was found that less than 40% of physicians used the standard protocol for ventilation. The question is, why do physicians have this propensity for altering treatment to fit their perception of what it should be, as opposed to the protocol that they ought to follow? Or put differently, why do they no longer follow the accepted protocol? This is an essential weakness of the professional as an individual decision maker.

- The image that physicians hold of themselves has another more serious weakness built into it. This is the assumption that medical students once qualified have acquired the complete body of knowledge of the profession (or at least know 50% of everything depending on university regulations). Society sanctions this belief by granting them a legal licence to practice their craft by virtue of their registration with medical council. They are now presumed to be professionals and "authorities" and the latter is someone society assumes does not err (McIntyre and Popper, 1983).

  The stage is now set for a tragic situation namely the fact that the world view of an "authority" includes the assumption that they can seldom be wrong. Physicians often make mistakes, but to uphold the image of an authority these mistakes can never be admitted. From here it is a short step to a belief that professionals do not make mistakes at all and integrating this into the personal image of a physician. Furthermore, the whole concept of learning by experience becomes meaningless unless there is a conscious effort to identify mistakes, analyse them and develop a strategy to avoid them in future. McIntyre and Popper make the point that the ultimate authority is our teachers in the halls of learning and that they have the biggest incentive of all not to be wrong. The deceit even starts with the examination of our students, which is a system that punishes students for mistakes and rewards them for hiding their ignorance. From a systemic point of view, a further complication is the fact that the admission of mistakes by the medical profession will not only seriously undermine the fragile image that society have of the professional,

but may also put members at risk for legal action, a growing industry in most parts of the world (Claassen and Verschoor, 1992:1).

Many suggested changes to the health care system threaten to erode the position of the physician as a professional with a subsequent loss of authority and control and, more importantly, status. It is possible that if this happens, the type of candidate who has selected medicine as a profession until now will no longer be willing to enter the profession. In other words, those candidates who put a high premium on individual freedom of movement and choice will be lost to the profession. This will have a profound effect on the kind of physician that will eventually be in the system, and in time may cause unforeseen changes to this system.

The study of the mistakes of treatment is part of the practice of medical audit, which is one of the pillars of managed care. The focus of audit is physicians and the outcome of their treatments (Brook and Lohr, 1985; Laffel and Blumenthal, 1989). The underlying assumption is that it is possible to accurately measure the efficacy of treatment (Brook and Lohr, 1985), which in turn is based upon a linear causality model (Brook and Lohr, 1985). In a system where physicians have little control over process, the outcome of audit has to be considered very carefully in terms of the complexity of the process and what may be happening, rather than what is assumed what is happening (Laffel and Blumenthal, 1989). Some studies have shown that performing an audit has very little impact on the way that physicians practise (Lomas et al. 1991). Lack of control over the treatment process may contribute to this finding.

There appears to be some confusion as to what exactly is meant by medical audit. Sheldon defines the activity as follows: *"Medical audit is a study of some part of the structure, process and outcome of medical care, carried out by those personally engaged in the activity concerned, to measure whether set objectives have been attained, and thus assess the quality of care delivered"* (Lawrence, 1993:2). The main objective of medical audit therefore is to measure the quality of health care. The term is often used interchangeably with peer review. According to Ellis and Sensky (Ellis and Sensky, 1991), there are eight kinds of audit.

i. Basic clinical audit. A broad analysis of case type, complications, morbidity and mortality in a department or of a particular physician. This is the morbidity sessions known to all medical students.
ii. Incident review. A discussion of strategies to be used for possible clinical scenarios for selected conditions if they should occur in the future, in other words a pro-active approach. This is a scenario based approach.
iii. Clinical record review. A random selection of case notes is reviewed against established criteria for such cases, in order to determine whether they vary from them.
iv. Criterion audit. Incidents are analysed retrospectively against chosen criteria which encapsulate what is considered to be the key elements in the management of such cases.
v. Screening of adverse events. A list of events (complications or problems) to be avoided is determined. The frequency and events leading to the occurrence of such events is analysed.
vi. Focused audit studies. Audit is done in terms of a focused area of research.
vii. Global audit. The collection and comparison of data across units, districts or even regions. This is similar to a meta-analysis.

viii. Audit of outcome. Criteria for successful outcomes are determined. Cases are then measured in terms of the success of such outcomes in terms of the processes and events leading up to them.

The problem is that medical audit, as mentioned earlier, is based on a linear concept of causality. It therefore assumes that illness and the processes involved in its resolution can be measured by simple mathematical models. It also assumes that physicians are in full control of these processes, an assumption that is compatible with a deterministic world view. There is nothing wrong with the concept of audit. However, it would be more meaningful if it were to be based upon a more comprehensive appreciation of the structure of the system(s) and the processes within it, in other words in terms of what happens in real terms. The latter approach assumes a circular causality model with complex interactions. The idea of control by the physician over the illness process is incompatible with such a world view

There is a further assumption that medical audit will be useful for finding a comprehensive list of practice policies. The idea is that the physician will then only have to look up a particular problem in a manual and then apply the formula with a guarantee that the problem will be successfully resolved (Eddy, 1990b). It is assumed that cost can be controlled in this way. The achievement of this goal in a complex environment is slim since it takes no account of the complexity of illness, the consultation system and the treatment delivery system. This assumption is based upon a mechanismic model of organisation.

- Physicians also bring their own personalities into the consultation. This includes their own cultural heritage and image of illness. For example, physicians who have grown up in the East may be more inclined to have a holistic approach to the problems of their patients. Also, physicians with a high pain threshold are less likely to prescribe strong narcotics to patients. The fears and insecurities of physicians, as well as their own illnesses also becomes part of the consultation. For example, narcotic addiction or schizophrenia may adversely affect the interaction. To uphold the image of the professional, there is a code of silence in medicine which prohibits any physician from commenting on the competence of a colleague (Saliso, 1996). There is a danger in this. Furthermore, the cultural heritage of physicians may create ethical problems in decision making. For example, a Catholic physician could have difficulty with abortion and contraception as treatment options (Gillon, 1985).

- Finally, physicians have an implicit assumption that they will be remunerated for their work, be it indirectly by an employer or directly by patients or their medical insurance. This is based upon a relationship of trust with patients. The trust is eroded when medical insurance claims are defaulted upon.

In summary, physicians also partake in the process of consultation with an enormously complex image of illness and health care in place which is the product of their environment as well as the health care system of which they are part. This includes the important self image of a professional with its assumptions about knowledge and effectiveness. The world view of physicians of illness and medical process therefore also has an influence on decision making and cost.

Any intervention that has the ability to alter the world view of patients and physicians, could have a profound influence upon health care delivery and therefore cost. Aligned self-control in a social system model of organisation is an example of such an intervention.

The remarks about purposeful behaviour of patients applies to physicians as well.

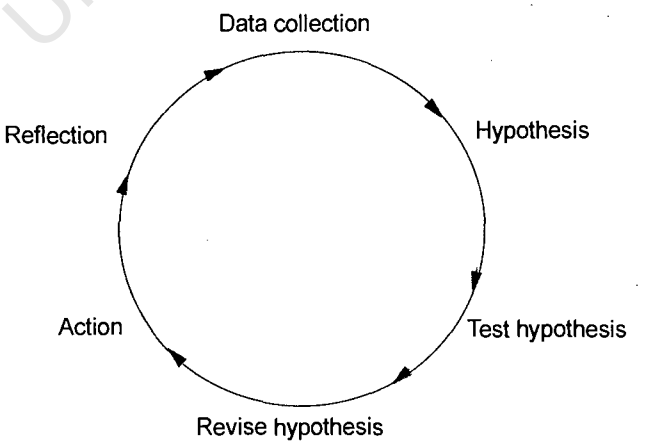
2.2 THE DIAGNOSTIC SYSTEM

The next section will take a closer look at diagnosis in terms of process. The purpose of this process is the collection of information and the manipulation of knowledge. If this system is not used properly as a system of inquiry, knowledge will not be used efficiently and decision making will lead to inefficiency and increased cost. It will be shown that this process is not functioning properly at present and that this, as a component of the patient-physician interaction, contributes to the problematique of health care. Efforts to increase the efficient use of knowledge in medical decision making may contribute to a more efficient system that is more cost effective. It will be shown that this process is applied in a linear way, but that it becomes more useful if altered into a circular process of inquiry, or a learning system. Furthermore, the flow of knowledge can only be efficient if health care interactions are functioning properly.

2.2.1 Diagnosis

The first step of a consultation is when patients explain their observed symptoms or concern to the physician (a question). Physicians now start an empirical process during which information is gathered (inquiry). This they do by questioning patients about the problem, its previous history and their background, in other words, they try to form an understanding of both patients and their illnesses in terms of their environment.

The process whereby information is gathered is continued during the physical examination. During this phase physicians will use all their senses, their eyes for observation, touch for palpation, ears for percussion and auscultation and smell for examination and side-room examinations. From the data collected in this way a problem list (differential diagnosis) will be constructed and the possibilities will be tested with special examinations, such as laboratory tests, radiology and endoscopy. The physician is now ready to make a diagnosis (state a hypothesis) and test it by way of treatment (this is fundamentally the cycle of inquiry of traditional science, see diagram 6). Traditionally, if the treatment is successful the process ends and the physician is reimbursed (Pistorius and Pistorius, 1986:210).

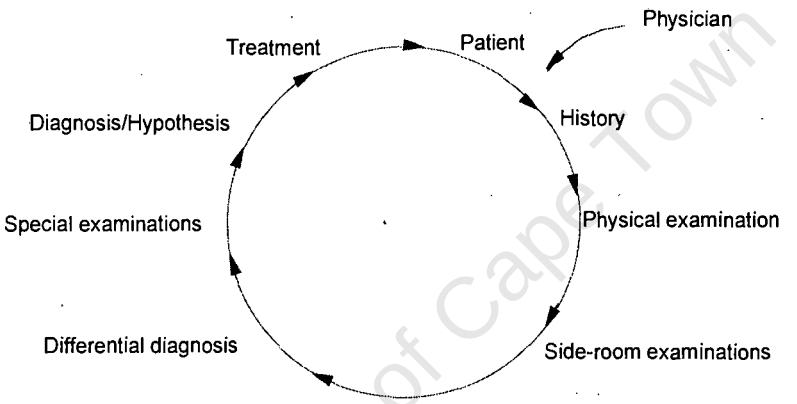


The diagnostic cycle
Diagram 6

If one looks at the diagnostic system taught to medical students, the observation is essentially that of a linear system (Pistorius and Pistorius, 1986:182; Chamberlain and Ogilvie, 1974:19). The dilemma with such a system is that it causes the practice of cookbook medicine. The formula is followed to the letter and like a cake, fortunately it usually results in a favourable result. However, it is a static approach and as such not very efficient. Looking at the classical diagnostic system again, one can differentiate three stages:

i. Observation and the collection of information.
ii. Speculation, based upon available knowledge and experience.
iii. Action (treatment).

Another way to look at this system, is to alter it to its logical form, which is a circular process (see diagram 7).



Medical diagnosis as a learning cycle
Diagram 7

The cycle starts when patients consult a physician (professional) about a change that they have detected in their physical or mental systems. The physician then gathers more information by taking a case history and by examining the patient. This data is integrated with the physician's own available knowledge and after reflection a provisional diagnosis (hypothesis) is postulated. This diagnosis is tested by the use of special examinations and treatment is then instituted on the basis of the diagnosis (thesis). The important last step is to observe the effect of treatment for future reference. Did it work? Why did it work or not work? How can I use this information in a similar situation the next time? Should the treatment be adjusted or changed to improve the result? What did I learn? The end point for patients is the satisfactory solution or dissolution of their problems.

The diagnostic cycle therefore in reality is a learning cycle and the process of diagnosis a learning system. There are two important components of the diagnostic cycle:

i. Experience. Learning can only take place in a system where reflection can take place, therefore a circular system.
ii. Knowledge. A poverty of knowledge has a detrimental effect on the efficiency of the system as a whole.

If we now take another look at the diagnostic cycle a frequent problem is seen. Many physicians tend to bypass the full cycle and form their hypothesis (diagnosis) based on a brief

history alone (see diagram 8). The physical examination is either abbreviated, or often left out altogether. Such an approach leads to diagnoses based on a shoestring budget and cannot be reconciled with either good scientific method or proper medical process. The reasons for this approach are multifactorial, some being a perceived need to accommodate a large number of patients within a short period of time (for monetary reasons, due to a shortage of physicians,,etc.), a belief in the physician's own perception that the process is unnecessary as a result of his experience, etc. Some physicians solve the problem of the poverty of information by resorting to further investigations, in the hope that any shortcomings in their approach will show up in the tests and can be rectified as a result thereof. Furthermore, it is assumed that testing will protect them from possible litigation (Claassen and Verschoor, 1992:3). This is an expensive, inefficient solution. It is also a system short of knowledge. It may be that this error occurs as a result of the tension between traditional intuitive medicine and modern "scientific" medicine as described in chapter 3, in other words the persistence of an archaic image.

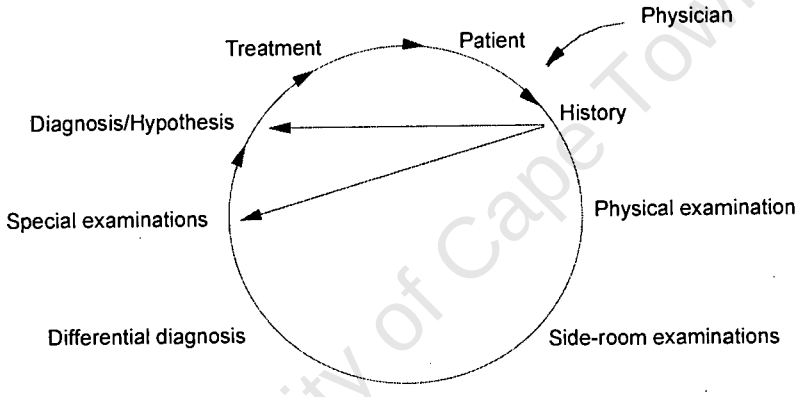


Diagram 8

The problem becomes magnified when the incorrect hypothesis is acted upon, i.e. treatment is prescribed. In most cases the outcome is relatively innocuous, but when surgery is advised it can have a more serious outcome. In 1976 specialists in Los Angeles county embarked on a go slow action during which only emergency procedures were performed. Over a period of five weeks the rate of surgery dropped by 60%. At the same time the mortality rates in the area dropped to the lowest level in five years, which promptly returned to "normal" when the strike ended (Cowley, 1993). The question arises, do physicians contribute significantly to the death rate and how? One reason could be the use of a poorly functioning diagnostic system.

A further problem is that a poorly functioning diagnostic system cannot operate properly as a learning system. By not integrating a complete set of information, very little learning can take place and furthermore possibly may lead to the learning of incorrect ideas. A vicious cycle is then created when such incorrect data becomes part of the physician's knowledge system, the end result being poor medical care, which in turn influences the cost of health care delivery.

It is the submission of this paper that the outcome of the treatment ought to be observed and reflection should then take place about the process and outcome. This phase of reflection is vital for the learning process and for experience to take place. Within the traditional method,

experience comes by repetition, almost by a process of conditioning, whereas in the suggested model experience is part of a process of conscious learning and the diagnostic system therefore becomes a learning system.

2.2.2 Knowledge

In terms of the diagnostic cycle, one has to ask what is medical knowledge and how is it acquired? Traditionally, medical students are given a prescribed list of reading, usually one book for each discipline, which is augmented with lectures and practical case studies. If at the end of their prescribed number of years they can convince their lecturers that they have absorbed more than the minimum amount of information required, they are deemed to know enough about medicine to practise their art. This approach gives rise to two absurdities. Firstly, the medical curriculum is known by students to be "*one per cent inspiration and ninety-nine per cent perspiration*" (TA Edison quoted in Cohen and Cohen, 1971:150)[44]. In other words, it lends itself to the memorisation of a large body of data. But in the process, little attempt is made to teach in addition to this a formal approach for retrieving the information in a logical way (Weed, 1968). The result is that the majority of physicians have a cookbook approach to their craft. You compare your data to that accumulated in your brain, find a match and apply the formula that is supposed to work. The educational system therefore reinforces the idea of the physician as authority, by contributing to the assumption that physicians have complete knowledge.

Secondly, the idea that learning the contents of an extremely limited number of texts will confer a broad and sufficient knowledge of the profession is ludicrous. The Scientific American published a figure that shows that if all the medical journals abstracted in the Medline bibliographic database of medical literature for one year were to be stacked on top of each other, it would form a pile one and a half times as high as the Washington Monument, which is about 500 feet high. This data is captured annually on 960 CD ROM's (Stix, 1994). Furthermore, 50% of this data will be obsolete within five years of publication (Ackoff, 1991:75). The amount of data absorbed by the average medical student pales into insignificance in comparison with this. To cap it all, there is no mechanism taught to these students to continue with self study. Subsequently the majority of physicians will make no more than a rudimentary effort to acquaint themselves with the knowledge explosion in their discipline. The question then is, how much do physicians know (Brook, 1994)? The answer is partly determined by the academic system of which they were trainees.

In some medical schools in the USA it is no longer necessary to cover all the disciplines in the medical field. For example, in 17% of all medical schools no formal lectures are given in urology and in the remaining 83% the number of lectures in this discipline average 8 in the whole curriculum. This translates into a situation where 10 to 15% of graduating students have never been exposed to urology (Benson, 1994). Approximately 3 to 5% of visits to generalists are for urological complaints and 6% of acute hospital admissions are for problems related to this field. The question then is, how much do generalists know, how do they deal with these cases and how can they act as gatekeepers for specialist urologists?

The knowledge explosion has forced the profession into breaking up into specialised disciplines, which in turn are fragmenting even further. The problem is that many physicians now know more about less. This has lead to an alienation from the patient. There is no reason to expect this trend to slow down and within this scenario, one has to question the viability of generalists in the future (Editorial, 1995), or probably more accurately, their present role. This is the fundamental weakness in the managed care concept of the generalist as gatekeeper

[44] The original quotation was about genius, the remark is adapted for this text.

(Anonymous, 1994b; Schwartz and Aaron, 1984; Teisberg and Porter, 1994). The question is; how can a person with an insufficient knowledge base be expected to determine when a more specialised service is needed?

The cost for treating an incorrectly referred or treated case is a serious problem. From a systems point of view a system with a poorly functioning gatekeeping design is doomed to become even more expensive in the long term. The challenge is to organise the large body of expertise into a coherent and well functioning whole. From this point of view, the generalist's role becomes extremely important, but only if it is redefined. It is a fact, that the practice of high-quality medicine produces fewer complications, better long-term results and subsequently lower cost (Teisberg and Porter, 1994; Milstein et al. 1989). The role of the FP therefore becomes that of securing and accessing such high-quality care. In terms of the discussion until now, the challenge is to alter the referral system into a learning system based upon the principles of a learning organisation.

The problem with a poverty of knowledge has a further important point. It is difficult if not impossible to form a proper hypothesis without a proper body of data (both knowledge and experience) which to refer to. Galileo would never have been able to discover the relativity theory in his time and neither would Einstein have if he was Galileo's contemporary. In the framework of medical diagnosis it is therefore difficult if not impossible to make a proper diagnosis without a sufficient database. Under such circumstances the diagnosis can be no more than Boulding's inspired guesswork (Boulding, 1987:30).

The difficulty of the interaction during a medical consultation has been described. There are further additions to complexity in relation to the diagnostic process.

- Many consultations are for complaints that are difficult, or in many cases impossible, to interpret or quantify. Physicians only have the assurance of patients that they do have a headache and they have to rely on the appreciation of patients that the headache is severe. This situation may be complicated by intricate psycho-social interactions that may contribute to it, such as an unhappy marriage, a fear for cancer, etc.

  This intuitive problem that exists in the patient's experience, now has to be integrated with known medical knowledge. The problem with this knowledge is the epistemological question; what do we know and how do we verify the accuracy of what we know? A major problem in medicine is the fact that up to 80% of treatments given to patients in good faith are untested for their ability to effectively solve the problem (Kingman, 1994).

- The present situation is that medical knowledge is based upon fact nets (Eddy, 1990b) (see chapter 1), often with dubious privileged contingent truths at its base. Many of these truths are of historical origin and are perpetually being passed on from textbook to textbook. When they are examined more closely, they are often found to be incorrect and this then causes whole fact nets to collapse. For example, Lowsley examined a few neonatal prostates in 1912 and created a model from this, which proposed that the adult prostate consists of six lobes (Lowsley, 1912). This is quoted to be correct as late as 1970 (Hutch and Rambo, 1970), but in 1972 John McNeal published his findings of dissections of adult human prostates, which conclusively showed this model to be incorrect (McNeal, 1972). This finding had a profound effect on modern research about the prostate, since the fact net supported by Lowsley's theory effectively had to be replaced. Unfortunately, a very large part of medical knowledge is based upon such theories and needs urgent revision (Brook and Lohr, 1985).

Furthermore, many treatments have been in use for countless years. When originally introduced they were valid within their time frame, but within a newer enlarged knowledge base they are no longer so. However, since in many cases they do not cause any obvious harm, the profession is loath to re-evaluate and discard what is no longer appropriate (Anonymous, 1991). One such example is the dilatation and curettage (D & C), which is frequently performed in woman and which in modern medicine has very limited indications, since better diagnostic tools are available. Yet, it is still commonly performed (Kingman, 1994). Another such procedure is neonatal circumcision, which can very rarely be justified by current medical knowledge alone (Wallerstein, 1985). There is therefore a need to systematically re-evaluate the foundations of medicine and to substantially correct the errors that are present (Brook and Lohr, 1985).

- It has been suggested earlier that medicine as a profession is not a science, however there has in recent years been an effort to give the profession scientific legitimacy. There is a noticeable shift towards a logistic community of inquirers (Eddy, 1990c). In other words, more time and money is spent within the profession on basic research and the ability to publish (or perish) is based upon the reviews of appointed or elected experts. The problem then becomes the deficiencies of the logistic system. The number of publications secure the legitimacy of researchers in the community and this expertise in turn allows them to decide upon the merits of the publication of other contributions. This therefore becomes a self-perpetuating cycle.

  Furthermore, there is a very heavy reliance on statistical methods to measure and interpret data. The aim of these methods are to serve as a measure of predictability[45]. Predictability (or the probability that an event will occur) in turn depends on a reliance on predictable systems and therefore linear causality. It has been argued elsewhere in this text that biological systems in general and health care systems in particular are non-linear (Goldberger et al. 1990). In addition, health care systems are social systems, which increase the complexity manifold. The measurement of human systems is an enormously complex problem and yet, today it is a prerequisite for medical publications.

  The position then is; are the right questions asked and are the conclusions drawn from them valid? The outcomes of medical interventions have potentially serious effects and the margin of error allowed is therefore very small. Who then guarantees the validity of medical research? The problem is solved by way of the community of experts (Feinstein, 1988; Eddy, 1990c), who answer such questions by agreement amongst themselves (Eddy, 1990b; Eddy, 1990c). These physicians have been granted this position by the medical community and their work is used to serve as an example for others. How do we know that the community has selected the right candidates and how do we know that their work is correct and ethical? The most important criterion at present appears to be the number of publications attached to an individual's name. There is a problem that the editors who choose the publication of texts are also a community that perpetuates itself. The danger of this is that important work may be denied publication whereas weaker papers are selected, because they are submitted by the right institutions or authors and are presented in an acceptable way. Furthermore, it is fascinating to see in medical literature papers where more than half of the quoted references are papers authored ór co-authored by the writer (for example Labrie, 1993). They themselves therefore give themselves scientific legitimacy. The point is therefore that this approach is a flawed one and that there is a danger in accepting a community of experts as a model for the medical profession.

[45] For a discussion on the problems of statistical methods, see (Churchman, 1948: chapter 1 and 2).

It is interesting to note that the pharmaceutical industry uses this reliance on the community of experts to promote their products to physicians. The way that this research is presented can profoundly influence the attitude and approach of physicians (Forrow et al. 1992; Naylor et al. 1992). If the data and conclusions are flawed, the communication is flawed and can potentially have serious effects. Products are introduced through the publications of selected experts. An underlying problem is the fact that by far the majority of these authors have had an incentive for publishing the data, either as a result of direct sponsorship, or indirectly by supporting the presentation of data at medical meetings that secures additional prestige, etc.

- Even if the data is presented accurately, the interpretation can be incorrect (Smith and Egger, 1994). Wiswell presented a lecture (Wiswell, 1992) during which he concluded that there are strong indications for neonatal circumcision. A meta-analysis was done of studies indicating a link between non-circumcision and urinary tract infections in boys. The findings were that infection occurred in 1,38% of non-circumcised boys, as opposed to 0,11% of circumcised boys, a more than ten times higher incidence. The conclusion was that this would support the advisability of neonatal circumcision. Furthermore, according to the author, sexually transmitted diseases almost exclusively occurs in non-circumcised men and can therefore be prevented by circumcision. There are a number of problems with this study.

  i. The implication is that to prevent 1 incident of urinary tract infection (a non-fatal condition) amongst 100 boys, 99 will have to be circumcised unnecessarily. This procedure is not free of complications.
  ii. The conclusions are based upon a linear causality model. In terms of multiple causality, a number of questions arise, such as; is the circumcision rite more frequently performed in higher socio-economic classes, in other words are there other reasons that can explain the findings?
  iii. Furthermore, only 1 - 4% of uncircumcised boys with colonisation with uropathogens under the foreskin developed infections. This appears to indicate that other co-producers must be active as well.
  iv. Wiswell asks the question whether uncircumcised boys have a higher rate of congenital malformations. It is not clear how neonatal circumcision will affect foetal development.
  v. The idea that circumcision prevents sexually transmitted diseases is emphatically wrong.

  The problem is that this presentation at a prestigious meeting, contributes not only to fact nets, but also to the application of a dubious treatment on a large number of cases.

- The traditional way of research in medicine is by way of randomised clinical trials. However, this approach suffers from a number of problems, such as the fact that they are time-consuming and expensive. Sample sizes are limited, there is difficulty in drawing conclusions about narrowly defined groups and they are usually performed under ideal circumstances (best physicians and best facilities)(Brook, 1994). The RAND Corporation recommended an alternative method, namely the synthesising of the knowledge and experience of experts (Brook et al. 1986; Brook, 1994; Brook and Lohr, 1985). The immediate problem is; who are the experts, how do we know that they are experts, how do we know that the experts have correct knowledge, how do we know that they will ask the right questions, what influences them into being part of the panel, who decides who the experts are, etc.?

- Medical research is based on a scientific model of control of the laboratory by the experimenter. In a highly complex environment, such as the patient-physician interaction, the experimenter has virtually no control over the experiment and its outcome. Any conclusion drawn from a study, has to be considered very carefully for its validity.

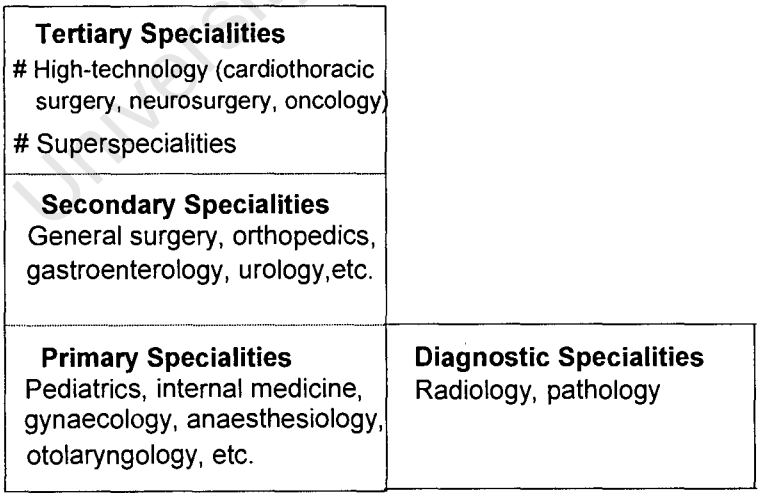
In conclusion, there is a dilemma about the scope of medical knowledge. The implication of this is that whatever knowledge is available ought to be used to the maximum effect, but with circumspection at the same time. Incorrect knowledge leads to incorrect decision making and incorrect learning in terms of a learning system. This in turn has important implications for the delivery of quality health care. The scope of medical knowledge is determined by the community of physicians. This is a complex social system in its own right and the proposals in this study are equally valid when applied to this group.

On the other hand, the current paradigm is to install into medical students a database of information that is assumed to be complete, correct and sufficient for life. In terms of a learning system model, a method for retrieving relevant information and gaining experience from it is more important than a rigid body of knowledge. This discussion therefore suggests that the current system of medical education is no longer appropriate in a modern health care system. A system is needed that will lead to thinking about illness in terms of wholes, and the principles of a systems approach may be an appropriate candidate for such a methodology.

2.2.3 The specialist referral system

Specialist. *A person who is trained in a particular branch of a profession* (Allen, 1992), or: *a physician who devotes himself to a special class of diseases* (Anonymous, 1965).

Additional access to the knowledge system in medicine can be achieved by using the specialist system. This system (diagram 9) consists of:

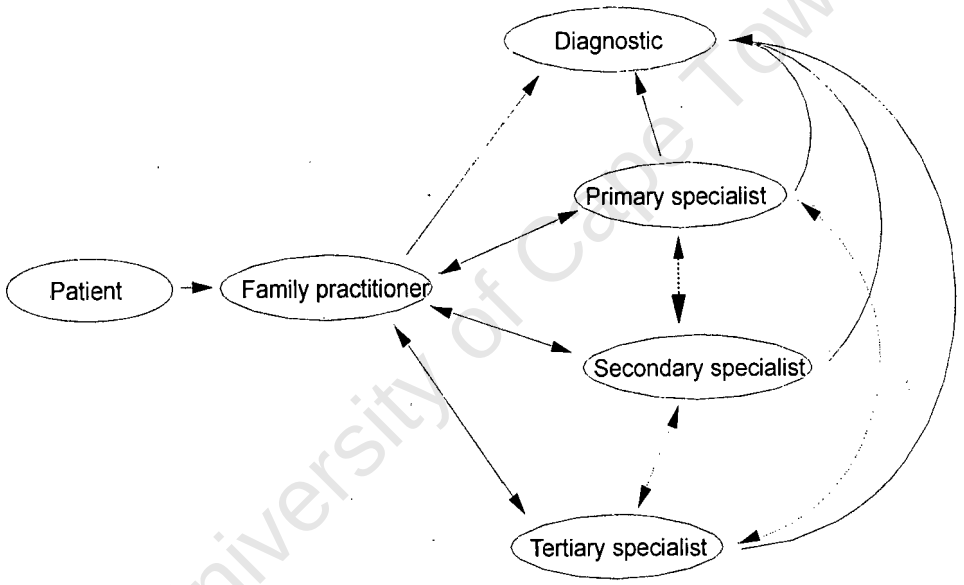


The structure of specialist medicine
Diagram 9

- The primary specialities (paediatrics, internal medicine, gynaecology, anaesthesiology and otolaryngology). Most referrals are from FP's and self-referrals from patients.

- The secondary specialities (general surgery, reconstructive surgery, orthopaedics, urology, gastro-enterology, cardiology, neurology, etc.). Most referrals are from FP's and other specialists.
- The tertiary specialities (high-technology disciplines such as cardio-thoracic surgery, neurosurgery, oncology, etc., and the super-specialities). Most referrals are from other specialists.
- The diagnostic specialities (radiology and pathology). Referrals are from FP's and all other specialists.

In terms of this structure, referrals to the diagnostic and primary specialities are almost exclusively from FP's and self referrals. As the complexity of the discipline increases, more referrals come from other specialists. (See diagram 10). Any system that interferes with this system will therefore affect the viability of the high-technology disciplines and also the delivery of services by them. The gatekeeper system used by managed care to control physician process and cost is such an intervention.



The traditional gatekeeper system
Diagram 10

The purpose of the specialist physician is to make available special knowledge and skills to the patient or referring physician. In the traditional system patients will consult the family practitioner, who will refer them to a specialist for a consultation or treatment. McWhinney (McWhinney, 1989:333) understands a consultation to mean that a person who may be a specialist is consulted. The patient is at no time under the care of the consultant unless referred and the opinion of the consultant is not considered to be binding, in other words the recommended course of action may be ignored. Referral implies the transfer of responsibility, although this transfer is considered to be partial only. A study was done that showed that 97% of exchanges between FP's and specialists are referrals and only 3% consultations (Rakel, 1990). The underlying assumption is that family practitioners are in control of the patient-physician system and that specialists are a resource that may be accessed by them (McWhinney, 1989):15).

The specialist system exhibits the following features:

- The family practitioner in the traditional system is the gatekeeper in charge of the patient-physician interaction (Hillman et al. 1992; Coulter, 1992). The gatekeeper concept is fundamental to all current models of change where control is implied and in particular in managed care and primary health care models (diagram 10). The assumption is that specialists are a major cause of the escalating expenses in the health care system, because they use expensive medication and are the main users of hospital care, which is a large contributor to the cost problem. Furthermore, it is assumed that keeping patients away from specialists will keep them away from hospital care and in this way there can be a major cost saving. In managed care systems, gatekeepers are rewarded in various ways (usually financially) for not referring patients, as an incentive to ensure compliance (Hillman et al. 1992).

  In managed care systems specialists are discouraged from re-referring patients to other specialists. Patients are to be referred back to family practitioners who decide whether re-referral is necessary.

  Gatekeeping is a cause of resentment to specialists. They feel that generalists withhold patients from them until their patients are in dire trouble, with a subsequent increase in the difficulty of problem solving and increased cost, which in turn is blamed on the specialist, with more gatekeeping, etc. Furthermore, as generalists do more work that is traditionally assumed to belong to specialists, there are less referrals and a reduced income. Specialists then have to find ways of supporting their income with more unnecessary procedures and treatments being performed, increased costs, more gatekeeping, etc. The gatekeeping concept therefore has a tendency to affect cost in a negative way. It has been suggested that gatekeeping eventually may only have a minimal effect on cost saving (Milstein et al. 1989).

  On the other hand, there is a feeling amongst generalists that the traditional pupil-teacher relationship which is the prevailing model in teaching hospitals is perpetuated in the generalist-specialist interaction. This is a cause of resentment amongst generalists (Balint, 1986). Many consultants act towards the FP as if they have a higher standing, which inhibits communication and subsequently the flow of available information. This in turn leads to increased cost, which reinforces the specialists' perception and therefore the pupil-teacher relationship.

  Furthermore, it is an underlying assumption that generalists have a broad knowledge and skill base that qualifies them to fulfil the gatekeeper function and which allows them to control the situation. In terms of a complex social system model and the discussion about knowledge, this assumption is a fallacy (Berwick, 1991).

  The problem with a gatekeeping system therefore is the following. Firstly, it is based upon a linear causality model, which has serious shortcomings in a complex system such as the health care system in terms of control. Secondly, this system is a barrier to the efficient flow of knowledge, which in turn leads to inefficient practice and therefore increased cost. In terms of a social systems model, this concept has to be addressed in order to achieve aligned self-control. Such a system will have the potential to improve efficiency and therefore reduce cost.

- It is a misconception that specialists know more or are more skilful than generalists, the only difference between them is in the depth and width of knowledge (Rakel, 1990). This belief combined with the gatekeeping concept means that if specialists share their

knowledge and skills with generalists, they are likely to lose more work, with a reduced income, etc. This affects cost, that in turn leads to more gatekeeping. It is therefore a barrier to the free exchange of knowledge in the health care system. Furthermore, in South Africa all specialists have originally been trained as family practitioners. In principle, they have the same knowledge as family practitioners, their specialist training adding to the scope of it. This assumption is based on the idea the professionals have complete knowledge.

- Only generalists have the necessary insight to select the appropriate specialist for a particular patient. The proper consultant is selected by the following criteria (Rakel, 1990):

  i. Knowledge.
  ii. Skills.
  iii. Personality compatible with the patient.
  iv. Availability.
  v. Ability to work well with the referring FP.

A study reported at the 90th Annual Meeting of the American Urological Association (Baum, 1995) reported the reasons for the selection of a particular specialist (see table 2). This finding is confirmed by the fact that the most important reasons for discontinuing referrals to a particular consultant are failure to send adequate reports and failure to return the patient back to the FP's care (Rakel, 1990). It is fascinating to compare both these lists with the earlier study of the reasons why patients select a specific physician. The above mentioned criteria cover two aspects, an empirical component which can potentially be measured (knowledge and skill) and an intuitive component which can not. Bedside manner and competency very rarely are found in the perfect combination in specialists. When a compromise then has to be made it will usually be biased towards the intuitive, since very few generalists in reality can judge the competence of specialists. In the AUA report, criteria of knowledge and skills actually play a very small role in referral. It seems to be a peculiar fact that physician referrals to other physicians are based on the same mental models that patients have. The result of this is that some of the best qualified and competent physicians often have the smallest practices, which can be explained on intuitive grounds but not empirically (Teisberg and Porter, 1994). This is not a finding peculiar to decision making in the medical profession alone (Tversky and Kahneman, 1974).

Table 2: Selection of specialists

Report back promptly	33%
Return patients to FP	22%
Available	13%
Friendly	17%
Give scientific talks	7%
Teach in hospital	4%
Teach in medical school	3%
Entertain	1%
Publish scientific papers	1%

A number of years ago a person who only had a standard eight school certificate was found to practise as a specialist paediatrician on the East Rand. He had referrals from "fellow physicians" for four years before his lack of expertise was detected. The implications and ramifications of this are mind-boggling. For one, no-one (colleagues, hospitals, medical insurers, patients) ever asked to see proof of his qualifications or

registration with the medical council. It would appear that there is an extraordinary trust in the medical profession and even amongst colleagues. The point is that a system that rewards an intuitive approach in preference to knowledge and skill, can only be an inefficient system. Furthermore, available knowledge and skills in such systems are not used to their optimal potential.

- Reasons for referral or consultation, are the following (Dixon, quoted in Rakel, 1990:248):

    - For a diagnosis (7,8% of referrals)
    - For management.
    - For diagnosis and management.
    - Request from the patient.
    - For confirmation of a diagnosis or plan of management

    On average, 2,7% (1 - 5,4%) of FP consultations are referred. The highest referral rate is for women between 15 to 44 years. Most of the referrals are for conditions affecting the neurological system and sense organs, followed by the genito-urinary system. Accordingly, most referrals are to neurologists, ophthalmologists, otolaryngologists, gynaecologists and urologists. These findings may reflect the demographic pattern of referrals.

    Fewer cases are referred in a FFS system (3,19%), than a managed care one (4,46%). The question then arises; are cases not referred because family practitioners are competent and have no need for consultation, or because they are incompetent and do not diagnose problems that ought to be referred (Rakel, 1990)? A further cause may be that it is more lucrative to treat patients in a FFS system, in other words family practitioners may do more than they ought to.

In summary, the referral process has a potentially large influence on patient care (Grant and Dixon, 1987) and therefore indirectly cost. The current system is based upon a world view that is the result of the historical development of the health care system. This view is an obstruction to the flow of knowledge and is therefore inefficient. The dilemma can be resolved if the prevailing view is tested and the format of the specialist system changed. The solution therefore lies in transforming the referral system into an efficiently functioning complex social system. Such a system ought to be a learning system.

2.2.4 Testing

A differential diagnosis is frequently tested by way of special investigations. The two most commonly performed groups of examination are:

i. endoscopy; and
ii. laboratory tests.

- Endoscopy has become very popular in recent years This is the result of an in improvement in lens systems, fibre optics and better light sources. It therefore becomes possible to observe parts of the human body from the inside such as with gastroscopy (the stomach), cystoscopy (the bladder), arthroscopy (joints), etc. The problem is that the interpretation of what endoscopists observe is highly subjective. Not only will the finding be influenced if they do the examination blinded to the background history, but also if repeated in the same patient on a number of occasions. As a result of this it is a notoriously difficult procedure to teach. The possible error rate becomes compounded by

the perception that physicians have of the problem. For example, they may ignore significant findings in a patient that they perceive to be a hypochondriac (error of the first kind), or diagnose an abnormality when it does not exist (error of the second kind).

The mental model of the teacher may become part of the mental model of the student and if incorrect the error is passed on and probably magnified from generation to generation. In both instances, action based upon the interpretation of data not only has potentially serious consequences for the patient, but also affects the cost of the health care system in total. Endoscopy therefore is a relatively simple examination, but the interpretation is enormously complex and fraught with error.

- Laboratory testing. The problem for the pathologist is similar to that of the endoscopist. Studies have shown significant variations in interpretation between qualified observers and also in the same observer on repeated evaluation of the same specimen. The possible error may have grave consequences. For example, for suspected carcinoma of the testicle the organ is explored surgically. During the procedure the vascular supply is interrupted to prevent spread of the suspected tumour along this route and a biopsy is then taken of the suspicious area. The pathologist will then examine the specimen in the theatre and the organ will be removed depending on his finding. I have experience of such a case where the pathologist reported a benign lesion and two days later realised that he had made an error. In this particular case this did not affect the prognosis, but in another case the outcome may have been grave.

Another area of error is sample collection. There is a very specific way that urine samples should be collected to yield accurate results (Kunin, 1987:195). Many patients will report that it has been done incorrectly when asked how their specimens were collected. This may be as a result of ignorance of the technician doing the collection, lack of interest, etc. This can lead to error, the possibility of which has to be included in any decision making process. Furthermore, in the laboratory situation the usual errors of measurement may occur. Was the processing of the specimen correct, was the equipment functioning properly (has it been properly calibrated), has the technician been properly trained in using the equipment, has the reading been taken correctly, etc. Some of the mistakes are errors of process, in other words occur when the testing protocol was not been followed accurately.

Human error needs to be considered. Has the specimen been correctly labelled and handled. For example, after hours urine samples must be refrigerated until they can be transferred to the laboratory. The person doing the collection may have neglected to do so and may hide the fact to escape censure. Specimens may be switched. The reality is that even in medical systems errors occur, but due to the seriousness of such error the margin allowed for error ought to approach zero.

The significance of error becomes serious if the indication for the tests are wrong (if the wrong question was asked). Blind faith in the ability of testing is a source of error, because tests are a guide and must be understood to be such. Furthermore, the use of tests to compensate for a lean diagnostic cycle could potentially lead to serious error.

The laboratory testing system is therefore a complex system on its own with many interactions that contribute to the successful completion of a test. However, the possibility that errors in such a complex interaction may have occurred must always be born in mind. Furthermore, due to the seriousness of errors, workers in such a system ought to share a strong ethical world view. The problem of diagnostic testing is that of

laboratory process, which is similar to testing in all scientific disciplines. This concept will be explored in more detail in chapter 5.

In summary, diagnostic testing is a complex process. The possibility that errors may have occurred always have to be considered in the decision making process, since such errors could have serious consequences if acted upon. The reliance on special examinations to compensate for an abbreviated diagnostic cycle (insufficient process) is therefore a high risk strategy. Therefore, special examinations contribute to knowledge about the problem, but are not in themselves a safe substitute.

The problem is that of the accurate verification of knowledge, which is similar to that of any other scientific discipline. The implication is that physicians ought to have knowledge of the process of inquiry to improve their decision making ability.

2.3 TREATMENT

The decision to treat and the specific treatment recommended, again opens up a number of complex interactions.

There is an implicit belief amongst physicians, that they are in full control of the consultation (Marwick, 1992). In reality, they probably control no more than half of the interaction at best. A large part of the consultation is made up of observer (physician) bias and the expectations of the patient (client), The rest being the scientific part or inquiry that may be controlled. The control of complex interactions is virtually impossible, and the consultative process is an example of such a process.

Equally, although they usually believe the contrary, physicians control only a small part of the treatment process (Rutstein et al. 1976; De Wet, 1991:24). Berwick (Berwick, 1991) describes some of the processes involved in an open heart operation. A successful outcome will depend on.

i. Whether the diagnosis is correct. This depends on whether the diagnostic cycle was followed correctly, which depends on the physician's knowledge and experience, the patient's co-operation, a properly functioning diagnostic process, etc..
ii. Whether the surgeon is competent. This depends on training (which depends on the educational system), experience (which depends on the number of similar cases performed), continuous education and whether active learning has taken place.
iii. Whether the blood bank cross-matched blood correctly and has the blood in the right place at the right time. This, in effect, is a laboratory system with all the attendant interactions.
iv. Whether the blood gas analysis machine works properly and the technician is trained to use it properly. This in turn depends on the manufacturing system that has produced the equipment and the competence of the technician, which in turn depends on training.
v. Whether the suturing and other equipment has been manufactured without any defects. This depends on a well functioning manufacturing and delivery system.
vi. Whether the nursing staff is competent to recover the patient. This depends on their training and whether the hospital has the necessary equipment available and these are functioning properly for them to perform the task.
vii. Whether the anaesthetic machine has been connected properly, has been calibrated properly and is functioning properly, in other words similar interactions to the other equipment.

viii. Whether the medication from the pharmacy has been labelled correctly. This in turn depends on a properly functioning dispensary system.
ix. Whether the instrument tray has been sterilised and packed properly, etc. This depends on a functioning sterilising system, in other words the whole process that instruments has to go through to be sterilised, including intervening human interactions.

The outcome is therefore dependant on a large number of highly complex interactions that includes the purposeful interaction of a number of related systems. In this highly complex interaction, the surgeon as an individual can control only a relatively minor part directly.

2.3.1 Decision making

The decision about the appropriate course of action to solve the patient's problem is based upon the integration of the result of the diagnostic cycle (empirical component) with the expectations and wants of patient and physician (intuitive component).

The decision to treat and the treatment recommended is often influenced by patients, their perception of the problem, their expectations of treatment and the way that these perceptions are transmitted to the physician (McNeil et al. 1982). Such preferences for treatment are not based upon statistical data but rather pre-existing beliefs. For example, often when a conservative approach is recommended patients will ask if they will not be getting a prescription, because many patients associate a prescription with good treatment. Or they may insist on an antibiotic for a cold or flu (and get it), because it is "usually given" even though there is no medical reason to do so. Physicians fear that they will get a reputation as poor professionals should they not oblige. Some patients insist on surgery even though it may not be necessary. The whole practice of reconstructive surgery is an example, where the most important reason for treatment usually is vanity. The problem therefore is a wants-needs dilemma. Physicians may take on the role that they sense patients expect of them, which in turn leads them to negate the protocols that they have learnt, with a subsequent effect on quality of treatment and cost.

There is data that suggests that decision making ought to involve patients. The attitude and values of patients are the key to selecting the correct treatment for a particular case (Wennberg, 1990; De Wet, 1991:36). An important point is that at the moment we do not really know what patient preferences are for treatment. At present these preferences are decided by physicians who may have preferences for a specific treatment different from patients. Wennberg in a paper concludes that the answers to health care problems will be found when physicians (and patients) come up with new ideas (Wennberg, 1990), in other words when they start interacting efficiently as a complex social system.

There is a wide variation in comparable treatments administered by different physicians (Wennberg et al. 1989; Brook and Lohr, 1985; Teisberg and Porter, 1994; Eddy, 1990c). Factors contributing to this are training, experience, knowledge, attitude, etc. Decisions are made within the perspective that an individual has of the problem (Tversky and Kahneman, 1981). If there is a chance that there will be a gain from a decision, decision taking will avoid risk, but if there is a perceived chance of loss, decision making involves risk taking. This means in the medical context that if it appears certain that a specific diagnosis is correct, physicians will not take the risk of selecting an unlikely hypothesis. But if patients are likely to have an adverse experience, they (patients) will be prepared to take risks. Furthermore, decisions are taken not logically (even in people trained in logic), but based upon biases that are part of the mental models that people, including physicians, have (Tversky and

Kahneman, 1974). This is why many medical decisions are based upon intuitive grounds rather than more logical well motivated reasons.

There is also a large variation in decision making amongst individual physicians. Observers looking at the same problem will disagree with each other 10 to 50% of the time. They will also change their minds 8 to 37% of the time when confronted with the same problem again (Eddy, 1990c). The implication is that many treatment decisions are wrong, both in the sense of a mistaken perception of the facts and because they are not in the patient's best interest. Such errors are usually not deliberate.

The approach and attitude of physicians to the problem influence the treatment. For example, many surgeons believe that any condition is potentially curable surgically. They would be more inclined to recommend surgery as opposed to physicians who are more conservatively inclined.

Another important factor on decision making is the influence of the environment. Important players here are business (the pharmaceutical industry and managed health care) and the state. In both the managed care and state health systems there is an incentive to control the physician. Many physicians probably join these institutions in the mistaken belief that if they are salaried they will not be influenced by the financial incentives referred to earlier. However, they exchange this comfort for control. For example, in some institutions in South Africa, heart transplants are no longer allowed. This creates a number of dilemmas. Firstly, there is the ethical dilemma that physicians face knowing that there is a treatment available that may help or even save patients. The question now arises; who makes the decision for withholding treatment, and more importantly who takes the responsibility? The problem of rationing is also one that is important in managed care. Why is the decision made to ration heart transplants? Should other expensive treatments then also be rationed, and if so which ones? Who decides which treatments are acceptable and which ones are not, and how does one know that the decision is the right one? Human lives are dependant on these decisions. This has become an ethical question of a village commons type and Vickers is correct in believing that time is running out and that sooner or later decisions will have to be made. Those decisions and the responsibility for them will have to be of a socio-political nature.

The fundamental difference between state control and managed care are the beneficiaries of the system. In the former the state, and therefore society, stands to benefit, but in the latter, although some schemes are ostensibly of a non-profit kind, the industry benefits. For example, medical aid administrators receive approximate 10% of turnover as commission. In 1994, in South Africa this amounted to R6 million. In the case of Medicross, the company is controlled by SA Druggists which in turn is part of the Malbak group. They therefore effectively sell the medical insurance that forces patients to attend their system, in which they control physicians who prescribe the drugs that they manufacture. The director of this company stated in public that the object of Medicross is to support those patients unable to afford full medical aid, but with a sufficient income not to be state patients (Benningfield, 1995). The fact is that they have not built any clinic other than in areas with a high density of traditional medical aid patients. The motive therefore is profit, mostly indirectly as shown.

The potential remuneration involved impacts on whether treatment will be given and which treatment will be preferred (Engelhardt and Rie, 1988). A drug, finasteride, was launched as an alternative to the surgical removal of the benign prostate gland in men. It is widely accepted that prostatectomy represents approximately 20% of the surgical case load of urologists and this procedure therefore represents a significant part of their income. As was to be expected, the drug was received rather frostily by the urological community, something that the manufacturing company found difficult to understand. Treatment, and in particular

surgical treatment, is more likely to be recommended should the physician be in a difficult financial position. This is likely to happen more often around the time that income tax payments are made and if there is an incentive such as a shareholding in the clinic in which the procedure will take place.

But it is not only the physician's remuneration that is involved in the decision. The whole health care system has an impact. For example, I treated a case in a private hospital and two weeks after discharge saw the patient again with a minor problem that needed readmission. The private hospital would not admit him again, because his medical insurance was exhausted. In other words, once the purse is empty they have no further moral obligation to attend to a patient in need, even though the treatment process has not been completed. The problem could not be treated at home, because there is no adequate infrastructure to do so safely (an environmental problem). The provincial hospital would admit him only as a fully paying private patient if the treatment is continued by a private practising physician (myself). Alternatively, he had to be admitted as a state subsidised patient, provided his treatment is taken over by the government employed physicians (a control and decision making problem). The fact that the attending physician felt morally and ethically obliged to continue treatment and was prepared to do so on a *pro deo* basis was not considered to be significant in the process.

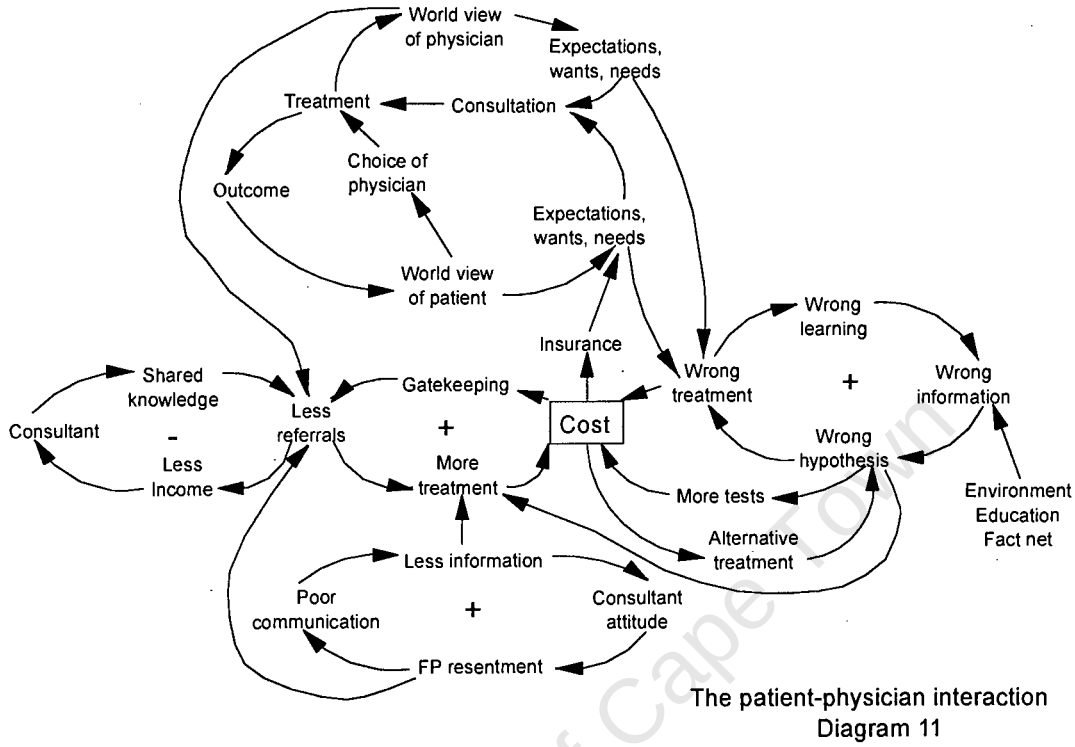
The pharmaceutical industry has a large and unaddressed interest in remuneration in health care. During 1994, 30% of medical insurance payments were for medicines. If the drugs and other items that are part of hospital bills are included as well, the figure is 50%. This amounted to an amount of R8 billion for 1994. It is a fact that these companies are businesses with traditional directors who report to shareholders whose main interest in the company, in turn, is their dividend. The purpose of the directors is therefore to ensure as large a dividend as possible for their shareholders. The value question of whether this should be done at the expense of sick people is an unanswered one. It is true that no new antibiotic has been discovered during the past twenty years. The reason is that the largest part of research is spent on the development of cardiac drugs, which is an extremely lucrative market. It is possible to cure many more people with more effective antibiotics than with cardiac drugs, but with less profit. The same is true for the research into medication for AIDS. The chance of finding a cure for this disease from a biological point of view is slim. However, the company that does so will have discovered the pot of gold at the end of the rainbow. Again, the value question of whether society benefits from this is unanswered.

There is a perception in the medical community that health care is either essentially free (government medicine), or purely a business transaction. If the latter position is to be accepted, the rules of decision making are no longer governed by traditional ethics, but by the profit motive. It is easy to come to such a belief, seen against the background of supporting health structures which are motivated by profit.

In conclusion then, the decision to treat, and the specific treatment recommended, is usually assumed to be a simple empirical decision based purely on medical indications. However, decision making in reality is influenced by patient wants, needs and expectations, physician wants, needs and expectations, and the influence upon both of the other components of the health care system. In other words, the decision making process can be influenced to suit the wants of patients, physicians and business interests in the health care system. This has serious implications in terms of the cost crisis in health care, and measures to correct this problem therefore have the potential to have a beneficial influence. It is proposed that the application of C West Churchman's system of inquiry may increase an awareness of how the decision to treat is made, which in turn may influence the consultation system.

3. Synthesis

The interactions of the patient-physician system that have been described, can be illustrated graphically in a systems dynamic model. (See diagram 11).



The patient-physician interaction
Diagram 11

The illustration can be summarised as follows:

- The world view that physicians have of illness, health care and their own roles, contributes to their expectations, wants and needs. The latter becomes part of the consultation in the ways discussed. The consultation leads to treatment that in turn reinforces the world view. The world view is shaped to a large extent by the physician's environment and in the case of family practitioners contribute to referral patterns.
- The outcome of treatment contributes to the world view of illness and health care that patients have, which in turn is the patient's contribution to the consultation. This world view also determines the patient's selection of physician, which in turn has an effect on treatment. As discussed, this world view is shaped mainly under the influence of the patient's environment.
- The expectations, needs and wants of both patients and physicians can lead to incorrect treatment, which has a negative effect on cost. Patient expectations are also influenced by the amount that they have to contribute to health insurance, which in turn is linked to health care cost.
- The amount of correct information and knowledge introduced during the diagnostic cycle has a large influence on the correctness of the hypothesis (diagnosis). A poverty of information is compensated for by more tests, which negatively influence cost. More importantly, incorrect diagnoses lead to incorrect treatment that in turn leads to wrong learning and therefore contribute towards a reinforcing cycle. The quality of information is decided by factors such as the environment, the diagnostic cycle, education and existing fact nets as discussed.
- Gatekeeping is a response to cost that is out of control. It can lead to late referrals and therefore more difficult problems, more treatment and more cost. It therefore contributes

toward a reinforcing cycle. Furthermore, gatekeeping reduces the number of referrals that leads to a reduced income for specialists and therefore an incentive to increase the amount of work.

- If specialists share their knowledge and experience with referring physicians, referrals may go down with a reduced income and therefore less incentive to share knowledge. There is an attendant incentive to increase the amount of work as a result of this.
- A superior attitude of consultants leads to resentment amongst family practitioners, that in turn contributes to poor communication and a deficiency of information. The latter contributes towards more than necessary treatment.
- High health care costs is an incentive for patients to try alternative treatments. This is often based upon incorrect diagnoses, which leads to inappropriate treatment and eventually more treatment. It can therefore have a negative influence on cost.

4. Conclusion

This chapter investigated the patient-physician system. In terms of this discussion the following can be deduced.

- The purpose of the patient-physician interaction is the resolution of the patient's problem (illness).
- This process is initiated during the consultation. This is a highly complex interaction towards which both patients and physicians contribute through their wants, needs and expectations. Assumptions (beliefs) underlying to the consultation are usually unstated. These include beliefs about illness, professionals and the health care system.
- The diagnostic system is the analytical part of the consultation system. The flow and use of knowledge in this system is not efficient at present. This is a barrier to successful diagnosis, learning and research. This could be improved by altering the process into a circular or learning cycle and also by altering the interchange of information in the physician system.
- The decision to treat is the synthesis of the consultation and diagnostic systems and is therefore influenced by the needs, wants and expectations of patients and physicians. The health care environment also has an influence on the decision to treat. Treatment activates complex chains of health care processes that eventually determines the cost to the system.
- It is the proposition of this study that a system of inquiry ought to be used in the patient-physician interaction that will improve the rigour of the decision making process. Such a system would have to include assumption testing of underlying belief systems, and a method for evaluating the accuracy of empirical medical knowledge.

In order to change the patient-physician system into a learning system, a methodology is needed that takes a broad view of the problem. Such a methodology is the systems approach. There are a number of systems methodologies that differ mostly in terms of their underlying philosophies. It is the aim of this study to introduce a methodology based upon a comprehensive general systems theory. The general systems theory and methodology of C West Churchman satisfies this criterium.

Chapter 5 is an introduction into Churchman's work and methodology. The principles identified in his work will be used to construct a possible solution to the problems in the health care system that have been identified in chapter 2.

CHAPTER 5

KNOWLEDGE AND INQUIRY

The work of C West Churchman as a basis for inquiry

Because of his writing style, the work of C West Churchman is difficult to follow and understand. However, in the opinion of this researcher he has made an important contribution towards our understanding of the process of inquiry. His work has followed a developmental path spanning from 1948 to the present and it is important to follow this path to follow his logic.

West Churchman was a pioneer of operations research and later the systems approach (Ulrich, 1988). An understanding of his work is therefore fundamental to any study of the latter. Many methodologies have his writings as their basis, including interactive planning (Russell Ackoff was his first PhD student), critical systems heuristics (Ulrich was a student of his), strategic assumption surfacing and testing, and soft systems methodology (Mason, Mitroff and Checkland were all influenced by their association with Churchman).

He felt later in his life that the new discipline of operations research had fallen into the trap of becoming part of establishment science, contrary to the ideal that he had had of a multidisciplinary science. As a result of this he felt himself more attracted to the systems approach, which is closer to his belief of a holistic approach to inquiry. He did warn however, that there are signs that the systems movement may follow a similar path, using systems analysis as an example of an associated discipline that had taken on a belief in measurement as a central philosophy (Churchman, 1979:44)[46]. This statement is as valid today as when it was made. The search for rigid methodologies and areas of application for the systems approach bears testimony to the fact that many researchers would like to see the discipline in a more main stream environment. Churchman's work could be interpreted to mean that such an approach is not systemic and in fact an enemy of the systems approach.

In *Methods of Inquiry* (1950), Churchman and Ackoff give an overview of the different philosophical traditions and the way that each of them is used in the process of inquiry. These traditions are still the most frequently used systems for inquiry in most disciplines in our modern scientific tradition. They show that each of them individually suffers from profound disadvantages, which individually makes them insufficient for the process of manipulating knowledge. The pragmatic tradition with its focus on goal satisfaction or purpose is possibly the closest to the ideal of a comprehensive system of inquiry. The pragmatist scientific method is one of controlled inquiry. The belief is that although inquirers can never have complete control over the process, they have a better chance of arriving at correct answers using this rather than other methods of inquiry and intuition in particular.

This concept is further developed in his next publication, *The Design of Inquiring Systems* (1971). Here, he shows that each of the traditions can contribute to the design of a collective system of inquiry. The Leibnizian inquirer's contribution is that of fact nets based upon contingent truths, which is the fundamental point of departure for all inquiring systems. The Lockean system adds to fact nets by consensus and measurement, and the Kantian inquirer through the concept of sweeping in opposing views of a problem (dialectic). The Hegelian system finds an antithesis for every thesis and tries to improve knowledge through the synthesis of new ideas from both. The Singerian system contributes the concept of comprehensiveness. This is based upon Singer's producer-product model of causality. In

[46] See also the imaginary debate between Herbert Simon and Churchman in Ulrich (Ulrich, 1994b:319).

other words, inquiry attempts to be comprehensive in order to include all possible objects in the environment that may contribute to an understanding of the object under study, an ideal that can never be attained but that can be approached forever. It also adds a value dimension to inquiry. The book ends with thoughts about the importance of social inquiry, which is something that Churchman felt to be of great personal importance. He saw social inquiry as a way to secure improvement (betterment) of the human condition.

The latter concept is developed further in *The Systems Approach and Its Enemies* (1979). He uses the term "enemies" to mean that part of social inquiry which cannot be quantified or understood by way of hard analysis. In other words, it is the way that people normally make decisions.

According to Ulrich (Ulrich, 1994b:34), the systems approach can only be rational if it can reflect upon its own limitations, in other words, by understanding the enemies[47] of the systems approach as a reflection of its own failure to be sufficiently comprehensive. This means that those who are critical of systems planning and comprehensiveness by virtue of the fact that they have to live the consequences of the plan, are competent to be so because they will be affected by the result of planning. Therefore, the affected cannot be expected to voice their concerns in a rational way.

The rational planning of the systems approach will always be in conflict with the subjective decision making of the enemies. This opposition or tension is represented by a dialectic approach. Improvement is therefore only possible if the affected that are planned for are prepared to implement the plan, which means that their concerns cannot be ignored in the planning process. To the affected, the planner's claim for comprehensiveness is an insult to their political, moral, religious, or aesthetic convictions. Politics, religion, morality, or aesthetics is what happens in the real world.

Churchman appears to have been interested in the epistemological questions: How do we acquire knowledge and how do we verify the accuracy of our knowledge? This in principle follows the pragmatist position of Singer, of whom Churchman was a student, and apparently heir apparent. The following is an interpretation of Churchman's work:

i. Inquiry can be either intuitive or logical (scientific). The only hope for progression, the successful solution of complex problems, and an improvement of the human condition, is by reason. However, reason by itself, contrary to what is often believed, is not perfect. Therefore, the deficiencies of reason have to be considered as part of any process of inquiry, something that can best be done by taking a broad enough view of the problem.

ii. No problem can be seen apart from the context of its past history. Similarly, the process of inquiry has the philosophical tradition of our Western cultural heritage as its roots. The different philosophical traditions are used in various disciplines in their inquiry into and acquisition of knowledge. A knowledge of this tradition is important for the understanding and design of any inquiring system. It also forms the basis of an understanding of the history of any problem with which the designer is confronted. This position will be developed by way of a summary and discussion of *Methods of Inquiry* later in this chapter.

iii. An important component of Churchman's philosophy is the concept of comprehensiveness. Each of the above mentioned traditions makes a specific contribution to, and are built into, the perspective of a satisfactory inquiring system as Churchman

[47] Ulrich interprets the term enemy to mean the irrational, which is in conflict with the systems approach, in other words the dialectic negation of the systems approach.

sees it. This follows a very subtle argument developed in *The Design of Inquiring Systems*, which will be discussed in the section summarising this work. This system is a systems approach. Churchman believes that the process of inquiry and assumption testing should be as wide as possible. If the inquiry is based upon a too narrow spectrum of inquiry, important facts, questions and insights will be missed, which may have a vital bearing on the eventual outcome of the inquiry. Churchman believes that the systems approach is the discipline best suited to satisfy this requirement (of comprehensiveness).

iv. The problem and solution should not only be examined from the position of this process of inquiry, but also from different other viewpoints to confirm the validity of the design and to ensure comprehensiveness. These viewpoints (the dialectical contribution of the Kantian inquirer) are called the enemies of the systems approach by Churchman, and will be discussed in a summary of *The Systems Approach and Its Enemies*. Only by including these viewpoints can comprehensiveness be ensured and consequently a systems approach followed.

v. Finally, Churchman feels strongly that planning should only be implemented if it can be shown to contribute towards the betterment of humankind. His insistence on an ethical approach is important, particularly in terms of this study.

Even if we are rigorous and exact in our inquiry, we often base some of the method and conclusions on assumptions (images) about the problem and life in general. These assumptions are fundamental to our ability to make life comprehensible and subsequently to create a framework from within which it becomes possible to function. Assumptions are also the seed of misunderstanding the problem, or the translation of the problem, when it is communicated between people. To be able to find truth, or a state approaching truth, we therefore have to analyse the assumptions that our decisions are made rigorously (make them conscious). Reflection on our statements will indicate the structural and intellectual background from which they have originated. If this background is incorrect or insufficient, it can be altered to better reflect the reality of the statement, or indicate in what way the statement should be altered to improve it. This reflection will lead to the realisation that the network of assumptions that we function on often originate in the philosophical base mentioned earlier. According to Ulrich, this process of questioning can be realised by the use of the critical method of the Kantian inquirer (Ulrich, 1994b).

This process of challenging and changing assumptions is based upon a concept of perpetual cyclical inquiry, in other words a learning system. According to Churchman, inquiry by way of the pragmatic tradition is a process continuously spiralling upward. This is similar to Dewey's concept of the learning process which is based upon the idea of goals, or ideals planning, which means that an ideal can never be achieved but can be approached indefinitely through a process of continuous adjustment. In this sense, the planning process is a never ending process of inquiry.

The value of Churchman's approach is the fact that it puts into position a framework within which we can ask questions (Ulrich, 1994a). In doing so, he gives no answers to problems, which is why the framework is an interwoven mesh, the parts of which are difficult to separate into a rigid framework.

1. The philosophical framework[48]

The Churchman framework is not necessarily a comprehensive or widely used classification, but it is sufficient for understanding the development of logic and therefore thought, from its beginnings. The thoughts and beliefs of philosophers are assigned to this framework, although this may in some cases be an arbitrary assignment. The point of the framework is not to supply a scientific or scholarly analysis of the discipline of philosophy, but to create a framework for understanding the history and process of inquiry. To argue the nuances of the fine print serves no particular purpose towards the purpose of the framework. It is also not meant to be a comprehensive analysis of the history of philosophy, but rather to sketch the outlines of its development in a logical way. An understanding of this framework is vital to the understanding and application of the rest of Churchman's work. What follows is a summary of the more important points of the framework.

1.1 RATIONALISM

Rationalism is a belief in reason as the basis for certainty in knowledge (Allen, 1992). Reason provides us with clear and distinct ideas and guides us to the conclusions we draw from these ideas. A fundamental problem of this approach is the identification of the clear and distinct ideas.

Plato (ca 427 - 347 BC) considers reason to be internal to man and one of the faculties of the soul. According to him, the universe is governed by the idea of the good. His famous parable of the cave suggests that we only sense the shadows of more perfect forms. The idea of the good governs the purpose of these forms. We deal with the ultimate form of things by reason and it follows that the highest reason contemplates the idea of the good.

The medieval rationalists attempted to reconcile reason with faith. The reason for this is probably that medieval philosophy was closely linked to the development of the Christian church (Russell, 1993:301).

The rationalist idea was completed into a more comprehensive system by Descartes (1596 - 1650), which signalled the start of modern philosophy (Russell, 1993:542). He emphasised the importance of reason within each individual with his famous "*cogito ergo sum*". The only truth is that which can be accepted without doubt as truth. This not only internalised the process of judgement of truth, but also regarded such truth as the starting point of all knowledge. We discover truth by the use of rational intuition and whatever follows by way of rigorous reasoning can also be accepted as certain truth. The implication of this system of thought is that we start at the roots, or beginning, with an absolute and pure truth and build or synthesise onto this further truths or proofs. The original truth is therefore derived by intuition and further truth arrived at by deductive reasoning, using the basic ideas as foundation.

One result of the Cartesian system has been reductionism. To understand a problem, break it down into its smallest parts. The individual parts are analysed to determine if they are absolutely true and the system is then reassembled again. This kind of system leads to the belief or assumption that the reassembled system will be optimal as far as function or truth is concerned. In other words, once the building blocks of the system are understood and optimised, the reassembled whole will be optimal and complete too. This assumption lies

[48] All quotations in this part, directly or indirectly are from: C West Churchman and Russell L Ackoff, Methods of Inquiry. An Introduction to Philosophy and Scientific Method (1950), Educational Publishers Inc.: St Louis.

implicitly or explicitly at the foundation of many modern management and scientific methods. It is also fundamental to the linear concept of causality.

1.1.1 Deduction.

To progress from an idea to a truth, a theorem or system of deduction is necessary. Two such systems have been used to address this need, namely the mathematical deductive system and formal logic. To be successful, the process of deduction has to distinguish between:

- The starting point of the process of deduction.
- The process of deduction itself.

The idea that a system should be developed for treating knowledge in its abstract form lead to the development of mathematics, or in its earliest form geometry. The implication of this is that mathematics is a language used to express logical thought. An integral need of mathematics is that for a deductive system. The earliest geometry and such a deductive system, was the one developed by the school of Pythagoras (died 495 BC). Their mathematical theory of deduction followed the following steps:

- State clearly and precisely the meanings of basic concepts.
- State the propositions that require no proof (elements).
- Deduce the remaining.

The best known of later geometers, was Euclid (ca 300 BC). Although his postulates have been overturned by non-Euclidian geometry, they are still the basis of mathematics taught in schools today. His eighth notion states: the whole is greater than any of its parts, an assumption still fundamental to many deductions. The Euclidian theory of deduction requires the ability to visually imagine the steps of the theorem and also how the postulates or axioms in the proof apply to the particular instance. It suffers not only from the problem of imagination, which some people may or may not have, but also leaves unanswered questions of definition and what can or cannot be assumed. The failure to solve these questions lead to the rise of non-Euclidian geometry.

Spinoza (1632 - 1677) unsuccessfully attempted to apply Euclidian deduction to non-geometric problems. After that, formally exact deductive systems persisted only in the discipline of mathematics. The reason is probably the preoccupation of rationalist thinkers with the starting point of deduction, as opposed to the process itself.

The alter ego of mathematical deduction, is philosophical deduction, or formal logic, usually associated with Aristotle (384 - 322 BC). He tried to show the different forms used in drawing conclusions from accepted premises. In the case of two premises and a conclusion, the argument is called a syllogism, an example of which is his famous:

All men are mortal.
Socrates is a man.
Therefore Socrates is mortal.

Both systems suffer from the same difficulty, namely what guarantee do we have that the initial truth grasped by intuition is an absolute truth. An attempt was made by Spinoza to address this problem by the law of contradiction which states: it is impossible for a thing to be both A and non-A at the same time. Leibniz used this law to formulate a modified idea of deduction as follows.

- Start with a perfect definition of things.
- Make no other assumptions except the law of contradiction.
- Derive all truths from these definitions and the law.

He also defined two kinds of truth, namely truth by reason or by fact. The first is necessary and the opposite impossible, and the second contingent and the opposite possible. The way things are defined is not important, as long as they are not contradictory. The fundamental problem, however, still exists: What guarantees the truth of the simple ideas? Leibniz solves the problem with the ontological proof. This proof is not a proof of reality and the end result is that rationalism cannot satisfactorily prove the truth of a statement. Leibniz's approach leads logically to the formation of interlinked facts, or fact nets. This concept will be explored further in the discussion of the design of inquiring systems.

The inability of rationalism to solve the problem of a guarantee for simple ideas resulted in the rationalist tradition in modern times being confined to metaphysics, where speculation and reason are the only methods used by the philosopher. In other words, the problem is side-stepped.

1.2 EMPIRICISM

Empiricism is the school of belief that truth is found by observation alone. Protagoras (500 - 411 BC) suggested that knowledge and perception is the same thing, from which it follows that every man is the measure of what is true. Aristotle suggested that we are born with the ability to sense. From what we sense we develop a memory and from repeated memories experience and knowledge. A process is necessary to enable us to move from specific memories to general knowledge. This process is called induction. The problem with induction, again, is: What guarantee do we have that the rule generated from our observations will always be absolutely true? In other words, even though we know that the sun comes up every morning, what guarantee is there that it will do so tomorrow? According to Aristotle the guarantee is intuition.

Empiricism was established by John Locke (1632 - 1704). According to him, simple ideas reach the mind as a result of the working of sensations (perception). They precede all rational processes. These sensations can then be expanded into forming more complex ideas by the use of:

- Abstraction.
- Compounding (joining ideas).
- Relating (comparing ideas).

When intuition acts on these facts, generalisations are formed which are validated by the existence of intuition itself. The problem, however, is that if we have not observed certain events ourselves, we have to rely on evidence from other sources to verify that they are true, or that they are probably true. There is also the problem of whether intuition on its own is sufficient as a criterion of simplicity. This guarantor problem leads to the notion in empiricism that there can be no certain knowledge in science, only probable truths.

It is only logical that the real test for empiricism will come when we are dealing with abstract concepts that we cannot observe and therefore cannot sense, such as the existence of the mind. Berkeley (1685 - 1753) suggested that the mind can only exist if it in turn is observed and it can only be observed by God. This in effect relies on a kind of ontological proof to make the theories of empiricism possible.

1.2.1 Causality

Much of the history of science has been devoted to constructing a system of related causal laws, which are designed to enable us to predict the future and describe the past on the basis of present knowledge. If we can identify causal laws, it will be possible to predict all the workings of the natural world and we would therefore know everything that can be known about it. According to Hume (1711 - 1776) causality is distinguished by the following principles:

- All causally related objects are in physical contact with each other.
- The cause is always prior to the effect in time.
- The cause and effect are necessarily connected.
  This last rule appears to imply that that if one event causes another, then whenever the event is present, the following event will necessarily follow. The problem is that one can observe these events but not the causal connection. The question then is: What guarantees the connection? Hume suggests that if we continually observe the events together, we eventually come to believe that the event will occur. The causal relation is therefore a belief, or an act of the mind, and the belief is a result of habit of association. These beliefs can be either without any doubt, or attended by a measure of uncertainty. In the latter case, we believe in the probability of an event occurring, based upon the experience of previous observation, where this experience has shown the events to occur repeatedly. In the same way, necessity is a belief created in the mind.

In the end, causality can only be shown to be present if the cause is both necessary and sufficient for the effect (Ackoff, 1981:10).

In the final analysis, empiricism finds itself in a position where knowledge is replaced by belief. All that we know with certainty are our impressions; our beliefs are based upon intuition.

1.3 CRITICISM

As a result of the weaknesses of the rationalist and empiricist positions, the idea that both rational intuition and empirical observation are essential for inquiry and that neither can exist separately came into being. This position was formulated by Immanuel Kant (1724 - 1804). He postulated that all knowledge begins with experience, but there are certain general assumptions that we have to make in order to make observations. The two most fundamental of these are the concepts of time and space. To recognise a train of events, we must observe the events to follow each other, which implies that an underlying concept of time is assumed. Similarly, to observe an object it has to have a spatial relation within which it can be observed, which implies an underlying assumption of a concept of space. These assumptions before experience he called apriori, because they are necessary to understand experience.

From observation we may progress to laws, which are called aposteriori. In order to understand the meaning of events in time, we have to assume that nature has an inherent regularity. This concept is important in the methods of most scientific methods[49]. It is important to note that Kant considered the tools of measurement of experience, arithmetic and geometry, to be apriori.

[49] There are newer disciplines such as chaos theory and the study of non-linearity that question this assumption.

1.4 SPECULATIVE METHOD

This method is the modern form of rationalism and proposes that at least some truths can be discovered independently of observation. This concept finds application today almost exclusively in the fields of metaphysics (ontology and epistemology), theology, and ethics. It is of more than passing interest to note that some of the more prominent concepts of modern sociology spring from this basis.

The thinker most responsible for the development of this method is Hegel (1770 - 1831). He argued that arriving at truth is not a deductive process of reduction, but instead a synthetic process. This is called a dialectic method, which is based on the following principles

- State a theory of the problem (thesis).
- Identify the contradictions in the position and also the opposing position
- (antithesis).
- Form a new position from the interaction of the two (synthesis).

Modern rationalism believes that the mind can grasp wholes or generalities on the basis of wide experience. These generalities are essential for truth and therefore prior to science. Metaphysical truth is therefore the result of creative acts of the mind.

1.5 POSITIVISTIC METHOD

This represents the nineteenth century continuation of empiricism. This method combines elements of rationalism, empiricism and criticism, although in its final formulation it is mostly empirical. It arose in direct opposition to the speculative method. An attempt was made to establish a scientific method on purely empirical grounds and in the process to deny deductive and speculative metaphysics. The method formulated was called logical analysis.

Comte (1797 - 1857) speculated that the mind developed through three stages; religious, metaphysical, and finally positive. According to him, science observe and describe events and form generalisations based upon them, which therefore are descriptive and not explanatory. In other words, the events that are observed by science and by which it begins can be known with certainty, but the generalisations or laws derived from them are always subject to doubt.

JS Mill (1808 - 1873) attacked the problem of causality and induction from the positivistic viewpoint. He suggested that we design ways of taking observations and that if the right design is used, a belief in necessary connections based upon a few critical observations can be established. The method he designed is the canons of induction. He established the principle that the cause must be both necessary and sufficient for the effect to take place.

i. The method of agreement (first canon). If two or more instances of the object under investigation have only one condition in common, then the only conditions in which all the conditions agree is the cause of the effect of the given object (necessary).
ii. The method of difference. If an instance in which the object under investigation occurs and an instance in which it does not occur have every condition in common, except the one occurring only in the first instance, then the conditions in which the two instances differ is the cause, effect, or an indispensable part of the cause of the object (sufficient).
iii. Joint method. If two or more instances in which the object occurs have only one condition in common, while two or more instances in which it does not occur have

nothing in common except for the absence of that condition, then the only circumstance in which the two sets of instances differ is the effect, or the cause or an indispensable part of the cause of the object.

iv. Method of residues. Subtract from any phenomenon any part that is known from previous inductions to be the effect of a certain antecedent and the residue of the phenomenon is the effect of the remaining antecedents.

v. Method of concomitant variations. Whatever object varies in any manner whenever another object varies in some particular manner, is either a cause or effect of that object, or is connected with it through some fact of causation.

The canons suffer from some difficulties, the most important of which is the underlying assumption that the environment of the experiment or observation can either be contained or controlled. Parts of these environments have to be ignored during observation and the question is: Which ones are selected for this fate, and how do we know whether they are important to the findings or not? The eventual effect of the method is, that some general assumptions have to be made about the surrounding environment in order to establish causal connections. It also means that in most cases causal laws have to be assumed to enable reasonable conclusions to be drawn from the observation. These canons are widely used in experimentation and have been used very effectively to obtain scientific knowledge in the past. The point is just to be aware of the assumptions underlying them and the influence that this may have on the validity of conclusions. These canons have had a significant influence on medical research. The problem of an environment from which parts have to be excluded to make conclusions has important implications for the validity of medical research. Of interest is the observation that for Hume causality is found by the repetition of observations, but for Mill the emphasis is on the design of the experiment. The assumption that the environment is value free and can be ignored is explicit in many modern scientific methods, including medicine.

1.6 LOGICAL POSITIVISM

This school has its roots in logical analysis as developed by Leibniz. His work was further developed by thinkers such as Boole (1815 - 1864), Peirce (1839 - 1914) and Frege (1848 - 1925) and culminated in its modern form in the work of Bertrand Russell (1872 - 1970). The purpose of this school is to produce clear and precise formulations of logic and mathematics in symbolic language. This makes the analysis of formal system construction possible. In the Kantian sense, the world is meaningless without a guiding framework of interpretation. For logical positivism, meaning is possible as a result of language.

Sentences can be logically true, or false (contradictions), or factually true, or false. In addition, there are emotive expressions without cognitive meaning. The latter is of importance in the analysis of ethics. Science can be divided into formal science, consisting of analytic statements established by logic and mathematics, and empirical science, consisting of synthetic statements based upon fact. Logical positivism concerns itself mostly with the former. It does so by studying the form of the language that are used to express these statements. In other words, truth is determined by the correctness of the structure of the language used for the expression.

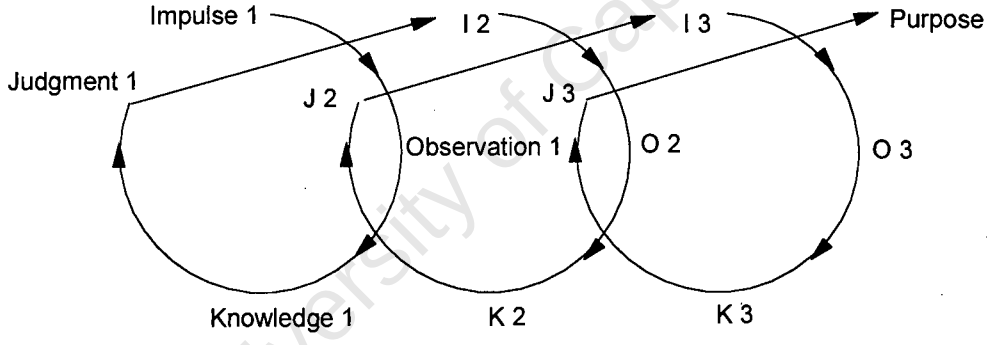
The method of logical positivism can be summarised as follows: A formal system is given an interpretation. Its axioms interpreted in this way become necessary laws which can never be completely confirmed empirically. From within this formal system we can deduce theorems that can be tested empirically. Laws can therefore be indirectly confirmed as being true.

1.7 PRAGMATISM

This school represents an attempt to synthesise a theory incorporating the strengths of rationalism and empiricism, but avoiding their weaknesses. The school is based on the work of Peirce (1839 - 1914), James (1842 - 1909) and Schiller (1864 - 1937). The modern exponents of the theory are Dewey (1859 - 1952) and Singer; Churchman was a student of the latter.

The pragmatic approach holds that:

- The effort to found science on a basis of observation or theory alone has failed to provide an adequate theory of scientific method.
- If science cannot begin with truth, it can attempt to end with truth. Science is therefore seen as an instrument for pursuing objectives (as a purposeful system).
- Both theory and observation are essential as instruments and not as fixed beginnings. The pragmatic conception is that truth is whatever works in practice, in other words that which contributes to achieving a purpose. Therefore, inquiry is a process of problem solving. The process of inquiry (see diagram 12) starts with a problem (uncertainty).



Dewey's model of experiential learning
Diagram 12

Enquirers have ends that they seek as objectives (purpose or goal), but there is doubt as to how they should proceed. Inquiry begins when individuals start to interact with their environment. The first significant step is to formulate the problem clearly. In fact, stating the problem contains the kernel of the solution. The problem is analysed for observable facts and from these facts a possible solution (idea) is suggested. For Dewey, such ideas can be used to forecast what will happen if certain operations are performed under certain conditions. A hypothesis is therefore formed when the relationship between the present problem in terms of the past is formulated by reason. The observed facts are not to be seen as evidence, but rather indicators of a possible solution to the problem. The hypothesis can be tested and the result of the test observed. The observations lead to revised or new suggestions and the process is repeated until the problem is resolved, in other words the purpose is achieved.

The process of inquiry leads to the accomplishment of a purpose or goal. For Dewey and Peirce, if there is common agreement amongst investigators, then an idea is true. Singer on the other hand argues that to define truth, the purpose that defines truth must go beyond individuals or societies, in other words must be more comprehensive. This school is known as non-relativistic pragmatism. Non-relativism can be characterised by two general tenets.

i. All problems of science are interrelated. (The implication of this is a systems approach). This is the concept of comprehensiveness.
ii. Progress in science is to be judged from an ethical point of view, in other words what science ought to do.

- The pragmatic ideals of science are:

i. The inquirer must have prior knowledge of some laws and facts, but these are uncertain and not a fixed starting point. The questions of science cannot be answered with certainty (the empirical position). Pragmatism asserts that in reality people accept assertions as true, not because they are known to be valid, but because they are accepted by the norms of a community as acceptable (the empirical inquirer). To the pragmatist, truth depends on the purpose of the investigation.
ii. Science strives for solutions without error. This constitutes an ideal that can be approached but never attained. The pragmatist ignores the possibility that an observation is incorrect, unless the outcome of the result is critical. The ideal of science is to provide information that can be used without risk, i.e. with hundred per cent certainty. The corollary to this is that truth is an ideal in which error and risk has been reduced to zero. This leads to the conclusion that truth as an objective can be approached forever, but never attained.

- The pragmatic method of inquiry for a science of ideals is the following:

i. Prior information. No experiment is ever brand new. New problems arise out of old solutions. The ideal is therefore to use as much of past and present research and data as possible. To understand a specific piece of information its history needs to be understood. The challenge is to introduce the maximum amount of information into the inquiry with the minimum waste of time and energy. An acceptable solution to this problem is to accept that a complete experiment can only be run with the involvement of collective science. This idea is based upon the principle that it is no longer possible for one person to know everything about anything. The time of the self-sufficient scientist is no longer achievable and the challenge now is to assemble collective enquiry across scientific barriers. This is a systems concept.
ii. The scientific model. This is the scheme that the experimenter uses to understand the underlying process of his study. The process of model construction is a continuously changing one.
iii. Criteria of pertinence. There is a need for criteria to guide the collection of information in a logical way. The alternative is a collection of an unstructured mass of facts. This means that the conditions under which data will be pertinent in the study need to be specified and to do that an idealised experimental model needs to be constructed.
iv. Measurement. The purpose of measurement is the prediction of outcomes. Prediction is how we decide our possible relationship to objects in the future.
v. Construction of alternative hypotheses. Scientific inquiry strives to state all the possible answers to a given question in any context. These alternatives are the

hypotheses to be tested. The pragmatic position is that the number and kinds of hypotheses depend on the purpose of the investigation. Presuppositions are the common perceptions between hypotheses that are used as the background for testing. To state this common ground is extremely important.

vi. Errors inherent in the test. Observations are recorded by way of measurements. No set of measurements can ever be perfect. We use statistical theory to tell us how to determine the error quantitatively and once obtained, how to minimise the risk of selecting the wrong hypothesis. Statistical methods are in turn based upon presuppositions that in turn must be included as part of the methodology. These methods are valuable in estimating the probability of a mistake being made.

vii. Weighting the alternatives. The risk of an experiment is a function of the chance for, and significance of a mistake. This introduces the need for the inclusion of value systems in the design of the experimental model. The value system is needed to make the goals of the experiment explicit and the goals or parts thereof that we would be prepared to forsake if the original goal cannot be achieved. These values are also important to determine the importance of any errors in the outcome of experiments, that is, the negative effects that they may have on their environment, including the human part of it.

viii. The planning of, and instructions for the experiment. This stage has to do with the gathering of information. The first question is the number of observations necessary to draw meaningful conclusions. This depends on the risk one is prepared to take when a conclusion is formulated, considering the data that has been gathered. This in turn depends on the seriousness of a mistake and the chance that it may occur. The methodology of the experiment must also be clearly set down, so that other experimenters are able to understand and duplicate the experiment. According to Churchman, this is not an easy task, since it demands considerable knowledge of how people respond to instructions. The ideal is to design and describe an experiment in such a way that it can be repeated by any number of experimenters that will all produce essentially the same results.

ix. Formulating a response. Experimenters have to draw conclusions about the findings of their inquiries in order to select an appropriate hypothesis. We often use statistical methods to analyse data in order to order it into a more effective whole. In pragmatism, some confirmation of the result is required. The degree of confirmation depends on the prior information we are willing to accept, the number of errors in the observations, the design of the experiments, and the number of observations, and the method for analysing data and drawing conclusions from it.

x. Evaluation of the results of the experiment. The perfect result to the experiment would be a hypothesis that is perfectly confirmed and one that is certain to lead to the attainment of an intended goal. The pragmatist position recognises that the ideal of an experiment in perfect isolation cannot be achieved. The experiment is therefore always purposeful and influenced by the actions and participation of the experimenter.

- Types of inquiry. The pragmatist position is that the experiment need not be delayed until the design is complete. Some sort of inquiry should be begun immediately, since the steps of the inquiry are usually not clear in advance. Some methods of inquiry that are useful in starting the process, are:

i. Speculative inquiry. This type of inquiry relies on intuition, discussion and vague rules of logic, and its aim is model construction.

ii. Pure empirical inquiry. This type of inquiry relies on the collection of information. The criteria of pertinence are derived by intuition and it often leads to speculation. Statistical methods are often used, but this does not lead to analysis of data.

iii. Conceptual empirical inquiry. The collection of information is determined by a partial scientific model that also supplies criteria for pertinence. There is a reliance on logic, exact language and mathematics.
iv. Mystical inquiry. This inquiry relies on feeling, such as in the field of aesthetics.
v. Practical inquiry. The same as conceptual empirical inquiry, but the inquiry is driven by an immediate goal.
vi. Planning inquiry. This type of inquiry has long-term designs and objectives. There is little data gathering and a heavy reliance on speculation.

The pragmatic approach to science is conceived in terms of its aims. Facts and concepts are instruments for action and have no meaning outside its context.

1.8 SUMMARY

In terms of this discussion, the pragmatist approach is the one best suited for inquiry. Churchman is a follower of Singer's non-relativistic pragmatism and in a sense further explored and developed Singer's ideas. The pragmatic approach is the one most complimentary to the systems approach. The essential characteristics of this approach are:

- Purposefulness.
- Cyclical inquiry.
- Ends can be approached infinitely, but never attained.
- Agreement.
- Every problem has a history.
- The concept of the single expert is no longer valid.
- Measurement is used for prediction and to minimise risk.
- No inquiry can take place in a value free environment.

In addition, Singer's non-relativistic pragmatism adds the concept that all problems are interrelated (comprehensiveness) and that progress is an ethical pursuit.

The pragmatist tradition is fundamental to the rest of the discussion and Churchman's work in particular.

2. Churchman's design of inquiring systems[50]

This work revisits and builds upon the theory set out in *Methods of Inquiry*.

2.1 DESIGN AND INQUIRY

According to Churchman, we attempt to change our environment for our own purpose. We do so by designing systems that enable us to achieve such a purpose. Design is therefore goal seeking (teleological or purposeful). Churchman recognises design by the following characteristics.

- It consciously tries to distinguish between different sets of behaviour patterns.
- It consciously tries to determine which behaviour pattern will be most suitable to achieve a specific goal.
- It tries to communicate this process to others so that they can achieve their goals in the manner that the design predicted.

[50] All quotations in this part, directly or indirectly are from: C West Churchman, The Design of Inquiring Systems. Basic Concepts of Systems and Organisation (1971). Basic Books Inc.: New York.

- The process followed to achieve a goal is recorded in a methodology, so that it can be used again if a similar problem occurs in the future.
- It identifies the complete relevant system and all of its components.

Churchman's "method" is both pragmatic and systems oriented, therefore he has an interest in the design of systems, or structures with organised components. In the design of such systems the boundaries and environment, in other words the size of the system, is of central importance. Closely related is the determination of the basic components that make up the particular system.

Churchman defines inquiry as an activity that produces knowledge. Knowledge, in turn, is a collection of information, or an activity or potential. In the latter sense, knowledge is the ability of a person to do something correctly. To know therefore, one has to be able to learn and adjust. *'Nothing touches the true depth of the human spirit so much as the act of knowing'* (Churchman, 1971:11).

The fundamental point is that in following these definitions, inquiring systems are learning systems (Ulrich, 1988) and it follows that the design of an inquiring system is important.

To be successful, one must be able to transform a design into action or another design. The central problem, however, is: How do we know that the knowledge we use for the design is valid?

2.2 WHOLE SYSTEMS AND GOAL SEEKING

Systems are purposeful, because some of their properties are functional. Whether or not something is a system is a design choice by the designer. Churchman makes the point that purposeful systems are enormously complex. For something to be conceived as a system, it needs to fulfil the following criteria.

i. The system is purposeful (teleological).
ii. The system has a measure of performance.
iii. The system has a client whose interests are served. The better the performance of the system the better the interests of the client are served. The client is therefore indirectly the standard of the measure of performance of the system.
iv. The system has purposeful components that contribute to the measure of performance of the system.
v. The system has an environment that also affects the measure of performance of the system.
vi. There is a decision maker who can change the measure of performance of the components of the system and therefore indirectly the system itself.
vii. There is a designer whose conceptualisation of the nature of the system is such that it can potentially influence the actions of the decision maker.
viii. The designer's intention is to change the system to maximise its value to the client.
ix. The system has a built in guarantee that the designer's intention can ultimately be realised.

The above is the original design of the "methodology" eventually refined into a framework in *Systems approach and Its Enemies*.

The client, decision maker and designer are purposeful individuals who can produce alternatives that lead to desired goals. They have a number of possible futures with a preference for some and to obtain this, they have a set of properties called objectives, or

goals. The designer has to imagine an environment in which clients can potentially achieve their goals within the limits of available resources (environmental constraints). In other words, there is a trade-off with what clients are prepared to relinquish, in order to achieve their goal as near as possible. To be successful, the designer will have to have a value system identical or similar to the client's.

The decision maker in turn controls the resources needed to change the system and therefore is the creator of the future. The co-producer of change is the environment, which is not under the control of the decision maker. The decision maker's value system is not necessarily similar to that of the client or designer.

The designer's (planner's) role is to attempt to guide decision makers into altering their value systems to a position compatible with that of the client (and planner). This is an important position to take and is fundamental to most systems methodologies. Part of the complexity is that the client, decision maker and designer may all be the same person or institution. One of the most important problems is to identify the client and decision maker correctly. The former is the person or entity whose interest ought to be served by the system. The systems approach is incompatible with short or medium term goals and it is therefore necessary to select a client who understands the importance of long-term planning.

Not all purposeful entities are systems. The difference is that systems can be separated into parts and that the parts work together for the benefit of the whole (see Ackoff's social system metaphor in chapter 1). The principle interest from this point of view to the designer is the relationship of the parts to the whole. (This is also a fundamental concept of the systems approach). It follows that one has to be able to visualise how and where a decision maker can alter a part and the effect that it may have on the whole.

The designer will regard an entity as a system, only if:

- it is regarded to be purposeful and have a measure of performance;
- it has purposeful components, each with a measure of performance; and
- the designer can conceptualise how changes in the performance of the components will produce changes in the performance of the system.

The latter also implies that the designer needs to select the best possible decision maker to implement the intended recommendations. Designers need to have a theory about the system as well as of their own role, so that they can form an understanding of how they can learn from the system and how they may influence it. The parts of a system cannot be separated in a design sense, but parts are identified in practice to obtain information about the effectiveness of the components of a system. This includes the setting of system boundaries, which is an arbitrary position.

The design must include some form of guarantee that it can succeed, otherwise there is no purpose in doing it. This can be done to some extent by built in design stability.

2.3 A THEORY OF KNOWLEDGE (EPISTEMOLOGY)

Central to most disciplines in science and also to many schools of philosophy, is the belief that the mind begins with simple things first and then builds this knowledge into a higher complexity. The second belief of these systems, is that the simple things that the systems begin with are inputs, either by sensory experience (from outside, the empirical position), or from innate knowledge (from inside, the rationalistic position). This knowledge can be seen

as given, the problem being that we do not know if these inputs are optimal as a point of departure. Following the above mentioned beliefs, design can either:

- Begin with elementary inputs that are clear and distinct.
- Begin with clear and distinct ideas that are not inputs.
- Begin with unclear inputs.
- Begin with unclear material that is not an input.

The disadvantages of each of these designs will be discussed, using the Churchman philosophical framework with which to explore them. There is also a subtle element of design in this discussion that builds itself into a comprehensive system of inquiry. Each point will be addressed respectively in terms of:

2.3.1 Fact nets; the Leibnizian (rationalistic) system.
2.3.2 Consensus; the Lockean (empirical) system.
2.3.3 Representations; the Kantian (speculative) system.
2.3.4 Dialectical planning; the Hegelian (modern rationalistic) inquirer.
2.3.5 Progress; the Singerian (pragmatist) system.

The object of the discussion is a design base open to its beginnings and in control of all the material in its possession. Together with this, input should be understood in terms of whether control of the origin of the system's material lies in or outside it. The Leibnizian system accepts choice as part of the system and is fundamental to all subsequent designs.

2.3.1 Fact nets (Leibnizian inquirers (monads))

For Leibniz, the learning process of the inquirer does not begin with clear and distinct valid truths. If the inquiring system can identify sentences and apply the fundamental laws of logic, then it can determine sentences that are tautologies (necessarily true), self-contradictory, or neither of the two (contingent). The interrelationships amongst contingent truths are more important to the inquirer than its clarity. The system starts with a set of definitions against which a sentence is compared. If the sentence follows logically from the definitions, it is a tautology. The Leibnizian processor therefore analyses only the form of the sentences proposed to it. For the modern inquirer, all sentences are contingent.

For the Leibnizian processor, perception originates within the system. A candidate sentence is formed when segments of perception are retrieved from memory and combined by means of imagination. The sentence is then processed through the stored rules of logic and becomes a contingent truth if it is neither a tautology, nor self-contradictory and can be linked to other sentences in the memory. These contingent truths are therefore linked together in fact nets, which grow as the perception stream continues. Contingent truths at the bottom of the net become privileged, since they are implied by most other sentences in the net. If they are false, the whole net collapses.

As mentioned earlier, according to Leibniz, the perception stream is internally generated. The inquirer contains all the elements that it will ever need (innate ideas) and search the stream for only those sentences that form a coherent truth. The implication of this is that the Leibnizian inquirer is a model builder. The rationalist problem of the validity of the contingent truths is solved by Leibniz with the ontological proof.

The Leibnizian inquirer is effectively in wide use in modern science. Results that fit into currently accepted fact nets are more easily accepted than facts not conforming to current theory. The latter are often ignored, because to accept them could endanger the theoretical

laws at the base of fact nets. (See also similarities in the discussion about image formation in chapter 1).

Leibnizian rationalism contains two ideas that are of importance in a systemic design. They are:

i. The need for an apriori theory of the whole (comprehensiveness), and
ii. The idea that all systems are fundamentally alike in the design of their components.

The Leibnizian system provides a framework to create a storehouse of knowledge. This knowledge is linked by fact nets, which gradually expand sets of contingent truths interlinked by appropriate relationships. The underlying principle is the idea that these fact nets are converging towards the absolute and ultimate truth. This can be seen as man's attempt to reach for God. This is the underlying assumption of science in general today.

2.3.2 Consensus (Lockean inquirer)

The Leibnizian inquirer, leaves two design problems:

i. What are the innate truths that the fact nets start with?
ii. The problem of a guarantor.

To avoid the possibility of starting fact nets with fallacies created by the human mind, the inquiring system needs a way for identifying only those contingent truths that appear to be valid. Observation would be an obvious candidate for fulfilling this role, but we know that our senses can be influenced by the environment or by our own imagination. The ideal of the empiricist is to identify the simplest observation that is a fundamental truth and basis for identifying contingent truths. The problem is that for this to be true, a community of observers has to agree about what they observe. Furthermore, there is not a simple way to design such an agreement, or confirm that agreement actually exists when one suspects that there is agreement. The Lockean inquirer is an attempt to design a community of minds that agree about their response to external stimuli (observation).

The fundamental problem with the Leibnizian inquirer is that it cannot identify as irrelevant and discard false data. A challenge to the design of the inquiring system is therefore to identify and include only relevant facts. This raises the question: How the designer knows that these facts are true. The empirical answer is that those items that are obtained by direct sensory input have a quality that by itself makes the item relevant and reliable. In other words, I trust what I observe. We have alluded to the problem of the guarantor this raises, and, in addition, there is the problem of identifying the simplicity of observation itself.

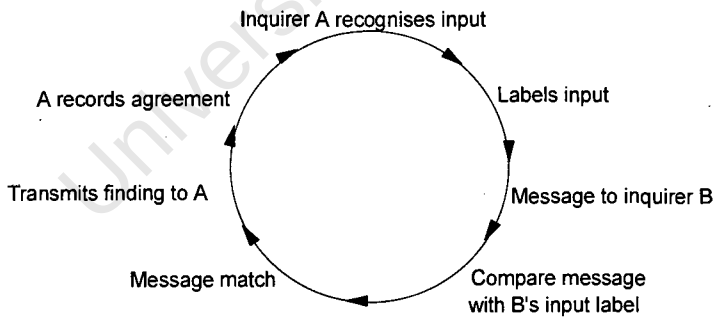
The Lockean system has no built in apriori preconception of the world to start with. Inquiry is started with an observed entity to which basic properties are added to form simple ideas. These ideas are then internally reflected upon, which is a process within the inquirer. Any idea in the Lockean system can always be logically traced back to its simplest elements. The information derived from a Lockean system can only have meaning if it can be used for a purpose. To be useful, a number of members of the system must be in agreement about the observed entities and the way that they are constructed into specific items. The design problem of this is how to build in a measure for the observation of the members of the system. A design will be successful when all the members of the community agree that an observation is simple. Members of the community are then able to generate true sentences from this basis.

The inquiry into the simplicity fundamental to the Lockean inquirer is therefore an inquiry into the community of inquirers. The inquirer acquires significance as a result of the existence of other similarly designed inquirers. This community of inquirers is necessary for the verification of empirical truth, but not sufficient. Agreement only exists if an overwhelming majority of members agree about the meaning of a simple observation, the introduction of uncertainty creates tremendous complexities in further design.

In reality, the agreement amongst inquirers often lead to a deeper inquiry into the circumstances of agreement and not to a termination of the process. The implication is that agreement as the end point may be an incorrect mode of design.

The Lockean inquirer has the ability not only to receive inputs, but also to recognise the fact that it has done so and from this can act upon the information by labelling it. These inner processes or reflections can then be shared with other inquirers. This can be transformed into reliable sentences in the indicative mood (simple statements of fact), if the whole community is in agreement about them.

The community of Lockean inquirers is designed in such a way as to develop a learning process, during which an attempt is made to generalise their experience through a process of induction. This induction is always contextual in practice. The goal of the Lockean inquirer is to create a large network of facts based upon the empirical observations of the community. An important design question is whether the generalisations arrived at in time influence the attitude of the community as regards the original elementary data. Agreement about an input may be based upon generalisations so that the basis of agreement is not invariable. Also, generalisations may direct the community into inquiry that strengthen or modify generalisations already in operation. The conclusions from a design point of view must then be that the design of agreement is entirely up to the designer. If designers are separate from the community, they can design the Lockean inquirer to agree in any way they desire.



Lockean agreement
Diagram 13

Agreement is essentially a circular process, as set out in diagram 13. It is also of importance to be aware that agreement is essentially a human quality. This creates a problem as far as the inclusion of objectivity in the design is concerned. An attempt is made to separate the community from its environment and larger system, leaving the design decision to the inquirer as part of the Lockean community. However, if the relationship with the larger system cannot be denied, the objectivity of empirical evidence attains meaning only from the community's interaction with this system.

The Lockean community attempts to conserve their purity in order to establish trees of knowledge as they see fit. In opposition to this, the school of pragmatism suggests that it is impossible to collect all relevant data and its interconnections. In order to derive use from knowledge, the inquirer has to select a small number from a large number of choices to analyse. This process takes place either consciously or unconsciously (by design or by chance). The degree of satisfaction that the person who uses the information derives from it, is the measure of the success of the retrieval of the data. If the retrieval does not satisfy the user, it should not have been retrieved in the first place. This kind of efficiency cannot be attained by the Lockean community, due to the poverty of its communication pattern.

In summary, the critical design questions of an empirical inquirer are:

- Innate ideas. The problem of the overall guarantor of the Leibnizian system is replaced by the problem of a guarantor for the correctness of inputs.
- Communication. An attempt is made to solve the guarantor problem by designing a community within a strict framework for its structure and the way this structure influences the recognition of data inputs and the generalisations derived from them. The design of such a system requires strong apriori commitments.
- Induction. Induction suffers from the same dilemma as before: What guarantees the validity of the observations from which it starts?
- Efficiency. A complete empirical inquiry is not an efficient basis for evaluating the basis of sampling. The objectivity of the Lockean inquirer is also determined by the larger system within which it functions and from which it cannot realistically isolate itself.

The Lockean inquirer addresses the Leibnizian problem of innate ideas and tries to solve the guarantor problem by way of the Lockean community. It leaves a new problem of design, namely the composition of the Lockean community.

2.3.3 Representations (Kantian inquirer)

Any input of the empirical type must presuppose a formal structure that can be expressed in terms of a formal language. According to Kant, the sciences of geometry, arithmetic and kinematics are apriori built into the inquiring system in order to enable it to receive inputs. An immediate problem again is: How are the assertions of these apriori sciences validated? Kant asserts that if any of them are denied, the inquirer would be unable to receive any inputs at all.

Kant implies that the inquiring system is capable of examining the methods by which it receives inputs and of discovering the presuppositions underlying the method. This process of self-examination (see the dialectic referred to later) is important to validate the principles of its apriori sciences. There is the problem of validating which of the apriori sciences is the correct one to select. For example, there are alternative mathematical systems today to the Euclidian system from which one can be selected.

This leaves the Kantian inquirer with two design questions:

i. How does the apriori structure influence the sections in the generalising area of the inquirer.
ii. How does the designer validate the apriori structure.

A problem of the empirical inquirer is the way in which sense impressions are formed. Kant postulates a space-time framework as a necessity for forming individual sense impressions. This implies a built in spatial framework, as well as a clock. A necessary connection between events must be assumed by the inquirer for sense impressions to have any meaning at all.

In many disciplines there is a strong tendency to separate the method of data collection from the method of creating theories. Subsequently, numbers are transmitted to the theoretical section but not information about the presuppositions made during their collection. This leads to one of two design philosophies developing:

i. The two design sectors are kept apart with a minimum transfer of knowledge. Each sector is judged separately for its effectiveness.
ii. The two sectors are inseparable. This creates a higher complexity in the system.

In the first design, a minimum set of apriori assumptions is assumed that are absolutely necessary for the system to receive inputs. A clock is built into the design that displays a series of events that are causally connected. In other words, B is necessarily followed by A, which means that preceding and following events can be accurately predicted. The events that follow in the inquirer are empirical. This raises the old problem of a guarantor for the clock. It follows that within an empirical inquirer the cause of unexplainable findings cannot be identified; one can only detect a problem in the process of inquiry.

This is not a problem in inquirers of the Leibnizian kind. Here, contradictions can be resolved by redefining the terms of the system. This makes it possible for the truths of one system to become the theories of another. By using this method, if the apriori structure is unable to explain events, a solution can be found by a redefinition of basic terms.

The way that information is presented has a strong influence on the success or failure of a solution. Also, not only does the problem solver search for a way to solve the problem, but also seeks to find the most economical (easy) method to do so. This creates a dilemma for optimal problem solving, because of a conflict between economy of method and the sparseness of information it implies, which leads to poverty of the problem solving process.

The richer Kantian design philosophy appears to address this problem. However, this design has the following critical design problems.

- Which are the simplest relevant inputs that are to be processed by the inquirer?
- How should the input be translated within the language of the model?
- How can it be determined whether the translated inputs provide a sufficient basis for translation?
- How does the designer know that a solution has been found?
- Is the design of a maximal apriori appropriate?

2.3.4 Dialectic (Hegelian inquiring system)

The aim of excellence of inquiry is objectivity. The problem is that any inquirer may test the validity of the objectivity of an inquiry by testing the method of inquiry. This implies that the inquirer is capable of being observed (Berkeley's dictum). The Kantian inquirer requires that the inquirer should have the ability to see the same objects from different viewpoints. On the other hand, the Lockean inquirer confirms objectivity by the application of agreement of the Lockean community.

Observation is either by inquirers on themselves, or by other independent observers. The problem with the latter is that they can only observe what they see, in other words they have no contact with the inner workings of the first inquirer's viewpoints. From the subjectivist doctrine (Hume), comes the notion that it is impossible to compare the values of two or more inquirers. It follows that subjective observations cannot be transferred accurately to other members of the community. This implies that the value systems of different members of society cannot be compared, apart from a simple ordering of preferences. The intensity of preference itself is a subjective evaluation that cannot be communicated to others. The point is that values cannot be measured in the same way as a scientific measurement, regardless of the fact that the calibration of the latter is notoriously difficult.

This position is a result of the assumption that the observer plays a detached role in inquiry. All inquiry is designed to emanate from the central set of operations of each inquirer. These observations cannot be observed, because to do so would lead to a loss of the basis for objectivity. Furthermore the central core attains direct knowledge and the further you progress outward from it, the more doubtful the abstractions of the inquiring system. Prediction therefore becomes impossible for the empirical system.

Subjectivism also assumes that observers can observe their own observations with maximum accuracy. This means that a distinction can be drawn between personal knowledge (of the observer) and communal knowledge (of the community of observers). For the latter, the observations must be carefully controlled and observed and to make this possible, the inquirer must set down the method applied in such a way that other inquirers may observe exactly the process followed by the observer. This distinction leaves no room for explicit design.

The design may be altered to one where it is assumed that own sensations of an inquirer means self observation as an object in the same way that a second inquirer would. This type of design removes the earlier restrictions of empirical inquiry.

With this model, the behaviour of the inquirer or inquirers can be observed and analysed. Alternatively, inquirers as well as their output can be observed and the effect of the interaction between inputs and outputs noted. In other words the effect that the inquirer had on the interpretation of data.

An objective response would exist if the observer could observe both the stimulus and inner state of the inquirer and link each stimulus to a single inner state. If, similarly, a single inner state and output can be linked together, the inquirer has reported objectively. Observers observe objects because it is part of their experience. It is furthermore observed to have a relationship with the internal states of the inquirer. This places the object outside the inquirer and hence it can be precisely determined whether two inquirers agree or not. According to Hegel, one mind observes another by the process of self-reflection, or self-consciousness. Objectivity is therefore a property of an observer of a subject, or a property of self-reflection. The latter is a necessary condition for objectivity but not sufficient. Subjectivity has not been eliminated in this kind of system. Its dilemma also is that the circumstances under which an object is represented cannot be captured in its essence.

Observation can be defined mechanically, or teleologically (purposefully). When observation takes place mechanically, alienation takes place because either the observer or the subject becomes passive and the other active. The observer and observed can never be the same mind and by necessity take the position of two opposites of a process. The former is the judge of the accuracy of information, which is taken to be independent of the wishes of the subject. Objectivity is confirmed if the stored information of the subject conforms with reality. If

information is factual (objective), it cannot change, even if the inquiring mind changes. Subjects are dominated by fact, since they have no choice about it. The subject is therefore subjugated by information, or more accurately the observer. The observer can accurately determine the past states of the subject, a situation that cannot be changed by the latter. This mechanistic hypothesis is fundamental to many, if not most, aspects of intellectual and social life.

Subjects accept this state and people accept facts, because:

- It is provided by experts (physicists, doctors, etc.). Experts achieve their status by peer recognition.
- It is a product of bureaucratic systems with built in controls (accounting systems, etc.). The participants of the system cause the acceptance of the system.
- It is of such a nature that there is no wish to disagree (weather, etc.)

The master observer appears from this to be the collective mind of all individuals. A master is not recognised:

- In moral matters.
- In accounts of souls, aid and philanthropy.
- On the causes of war and poverty.

Therefore, experts can inform about facts, but not values. (This is the fundamental position of ideals planning). The benefits of the subject delegating authority or not, are determined by:

- the benefit of a policy, and
- the cost of implementing the policy.

In the case of an expert opinion, it is impossible to get the opinion without consulting such an individual. Experts therefore have to be trusted, but they may sometimes be wrong, which constitutes the cost of the policy. In matters of ethics or values, experts disagree and therefore the cost of the policy is high. It is therefore the responsibility of the subject to accede to management by experts in those situations where the benefits outweigh the disadvantages. This is a teleological (purposeful) approach to knowledge and the facts then become a creation of he subject's own policy.

The teleological inquiring system starts off by creating a world view (weltanschauung). The teleological theory of information means that information derives its validity from the world view into which it is embedded, therefore master observers can only attain objective information if they select the correct world view. For Hegel, the master observer is substituted for by the dialectical method. The process starts with the collection of information over as broad a spectrum as possible (compare with Churchman's concept of the sweeping in process). This is used to formulate a thesis. A world view is created to interpret the data in defence of the thesis, or put differently, there is a way to look at reality so that data can be used to support the thesis. In the Hegelian inquirer, observers act in opposition to subjects. They observe subjects and propose an antithesis to them, in other words they act in opposition. The antithesis is developed using the same data and world view of the thesis (compare with Churchman's enemies of the systems approach).

Out of the thesis and antithesis a new world view, the synthesis, is developed. This act of forming a higher argument creates a conviction of the truth of such a view. The approach of argument and counter argument will conceivably eventually eradicate all doubt, and the fact

that the problem has been examined from every conceivable angle, means that it has been observed objectively.

The problem of the Hegelian system, is that the mere analysis by thesis-antithesis does not guarantee the breadth of inquiry. It is also a system given to a leisurely inquiry not constrained by time and cost. The thesis is only one viewpoint selected from a large number of options. There is therefore a question about how it came to arise in the first instance.

The Lockean system starts with fundamental data that is constructed into a story. The Kantian system tells the same story starting from different viewpoints. The Hegelian system tells two different stories using the same information.

2.3.5 Progress (Singerian inquirer)

Singer chose as his starting point the science of measurement or metrology. This means the steps to be performed in order to make measurements and the way that these measurements are justified as accurate readings of some aspect of reality. Measurement becomes important in terms of the comparison of alternative options to achieve a desired objective.

To measure, the unit and standard of measurement must be selected. The unit of measurement is an arbitrary choice, but the standard is not. A measuring system requires a rule generating system that describes the methodology of the measurement, a manufacturer of the measuring device, an observer who can follow the method and record his findings, and a second observer who can compare the findings of the first observer. This implies an assumption that the first and second observers have basically the same measuring system. Such a system is based on a Lockean inquirer. The system leans heavily on the principle of a standard, which is a set of operations that will resolve any disagreement in the Lockean community.

An important question is: How do you measure the performance of a system? In a length measuring system the important factor is the ability to replicate, in other words repeated readings should be in agreement. If they are not, then the system does not accurately describe reality. On the other hand, readings that are in agreement do not necessarily suggest that the system is working properly. The reason for this may be that:

i. The measured object and measuring device remains unchanged over a period of time.
ii. The object fluctuates in length while the measuring device remains unaltered.
iii. The object remains unaltered while the measuring device does not.
iv. Both object and measuring device fluctuate.

These remarks suggest the creation of a Hegelian over-observer. In cases ii. and iii. a competent observer would be expected to find inconsistent readings upon making independent observations. Competence, inconsistency and independence are judgements of the over-observer who also determines whether the methodology has been followed correctly and whether the observer's responses are influencing the observations.

If a hypothesis is tested and the readings confirm the theory, no amount of additional testing will decide whether another hypothesis based on the same data is false.

According to Singer, when all readings agree the system must shift to a higher level of refinement of the data. This rule is applied until a level is reached where not all readings agree. The inquiring system, in applying this rule, commits itself to the assumption that every meaningful descriptor of natural objects can be partitioned. This assumption is usually

expressed by a mathematical quantification that is based on the further assumption that nature can be reduced to a set of descriptors that cannot be partitioned. The Singerian system is therefore applied until the system reaches a level of refinement of its readings where not all readings agree.

A further problem of disagreement is to decide which of the four cases of relationship mentioned earlier is the cause of disagreement, a question of analysis of variation, that is, whether a variation or disagreement is significant or not. In the Lockean community disagreements are created to attain a higher level of agreement

The partitioning rule in the end states that if two contrary hypotheses are both consistent with a set of adjusted readings at a certain specified level of refinement, then there exists some higher level where one or both will fail to be consistent. This however does not take into account the resilience of general hypotheses about the natural world, or the strong relationship between hypotheses and readings. If a hypothesis is considered to be inconsistent with a set of readings, one of the following strategies may be followed.

- Revise the hypothesis.
- Revise the procedure for adjusting readings.
- Tolerate the inconsistency until more information is available.

A most subtle and difficult design problem of the Singerian inquirer is called Kant's problem by Churchman. This is the revision of the apriori (Kant), or world view (Hegel), or natural image (Singer). The decision to review depends on the purpose and measure of performance of the system. The Leibnizian system allows competition amongst world views, which means that revision depends on the weight of the competition. The Lockean system depends on a community of reasonable people whose agreement becomes the basis for acceptance or revision. Kant's position is that the community shares a common apriori mode for shaping and interpreting data, the question being whether the data is shaped appropriately. The Hegelian system requires that a counter-weltanschauung be created once there is agreement, but this does not give an indication of whether this will serve any purpose.

The philosophical tool of symbolic logic reveals the design features of proof but not discovery, in other words, how problems are to be solved rather than which problems ought to be solved. According to Singer, the attempt to reconstruct the inquiring system by logic alone is wrong since it should include the whole scope of inquiry. The question is: What is the whole scope of inquiry?

The Singerian system does not have the components of authority and control as a necessity for design. These components are part of the incorrect assumption that authority or leadership is available in the system for reference when in doubt. Control implies that a component of the system can observe and correct it. In the Singerian system control and authority is not located in a specific position in the system, in other words the system is controlled but has no controller. This leads to the reality that the Singerian inquirer has to encompass the whole breadth of inquiry in an attempt to authorise and control its procedures.

To revise readings, Singer uses the sweeping-in process. This means that the inquiry starts with traditional logic and that further dimensions are added from other sciences, each addition's dimensions being noted. This sweeping-in process therefore serves to overcome inconsistencies of readings. This in effect is another way of building a Leibnizian fact net.

A fundamental aspect of the Singerian inquirer is the fact that it is an endless process. This is a result of the fact that this system is based on the Hegelian system. In other words, when

data and hypothesis are compatible, it is time to formulate the antithesis. The implication of the dialectical method is that two opposing processes are at work in the inquiring system, the two sides of the coin so to speak. The object of this system, contrary to the Lockean system, is not to resolve disputes but to continuously stimulate debate about them. It is a purposeful system with an ethical base. In terms of the earlier conditions for a purposeful system:

i. This inquiring system has the purpose of creating knowledge for choosing the right means for one's desired ends.
ii. The measure of performance is the level of scientific and educational excellence of a society.
iii. The client is all mankind.
iv. The components are all the disciplines.
v. The environment is the whole social system. Singer's theory of value is based upon the assessment of man's ability for attaining their wants and not an assessment of their goals.
vi. The decision makers are not everyone in the ideal, but in reality the heroes or people inspired to instigate change.
vii. and viii. In the ideal, the designers are everybody, and progress can be measured in terms of which the designer, client, and decision maker are the same.
ix. The guarantor is betterment.

Finally, it would appear as if Singer's process, or heroism, is in opposition (a dialectic position) to progress, the production-science-co-operation trilogy of the nineteenth century. The latter aims at a world of enlightenment where individuals are empowered to live out their lives in their own ways. Heroism on the other hand is an effort to contribute towards the betterment of all mankind.

The second part of *The Design of Inquiring Systems* essentially has creativity, or the meaning of design as its unifying theme. In it, Churchman struggles with the complexities of life as introduced by the metaphysical part of life, theology, human interaction, etc. The position of progress is criticised for its inability to deliver on its promise for a better life for every individual. In this sense, science has failed in its effort to better society, particularly as a result of its insistence on the empirical. The question then is, can this be rectified by an approach such as the systems approach?

2.4 SUMMARY

Inquiry is the process whereby we acquire knowledge. According to Churchman, a system for doing so can be synthesised by including a number of philosophical positions. Inquiry therefore has the following characteristics:

i. Knowledge starts with simple things that are synthesised into higher complexity. In this way fact nets are constructed based upon contingent truths.
ii. Contingent truths can be discovered by observation. However, there is no guarantee for the accuracy of observation and therefore objectivity. Observations usually are verified by agreement amongst a community of observers.
iii. All forms of observation assume some presuppositions without which it has no meaning. These presuppositions can be discovered by self-examination.
iv. Objectivity is confirmed by an external observer or internally by self-reflection. Observation can be either mechanical, where either observer or subject is passive, or purposeful. Mechanical systems are value free and knowledge derived from them can be discovered by experts. Purposeful systems are value inclusive and therefore have no experts. Values are valid in terms of a predetermined world view. Such world views can

be tested by a dialectic method that leads to a higher argument and therefore objectivity, in other words self-reflection is done by the dialectical method.

v. Inquiry starts with logic and continues until there appears to a logical solution. At this point other dimensions have to be swept into the argument. The effect of this on the inquiry is observed until there is agreement again, at which time more dimensions are swept in, etc. Inquiry is therefore a timeless exercise. In terms of purposeful systems, when data appears to be consistent, a dialectical process is started that will lead to new debate. The purpose is to ensure that data is sufficient to ensure the best possible decision. This has great importance in making value decisions. Mistakes in decision making can be avoided by making a sufficiently broad inquiry into the problem.

3. The Systems Approach and Its Enemies (Churchman, 1979)

3.1 THE SYSTEMS APPROACH

3.1.1 Comprehensiveness

Design can either be approached simplistically, where we feel the need to do something about a problem urgently (and embark on a road of possible disaster), or in a comprehensive way (taking a broad view), where the consequences of any proposal are considered carefully (by rational inquiry). The implication is that a comprehensive approach is a long-term one and is therefore not suitable for finding short-term solutions. This is a systems approach to the process of inquiry.

Every problem has an environment within which it operates and any alteration to the system will affect the environment, often in unforeseen ways. The environmental fallacy (fallacy of ignoring the environment) therefore states that the total environment of a problem is more difficult and more important to perceive than its physical environment alone. This fallacy can be avoided by the use of a systems approach, in other words by taking a sufficiently broad view of the problem, the need to satisfy the requirement for comprehensiveness is solved.

Churchman was attracted by Singer's philosophy of comprehensiveness. It means that a wide perspective has to be "swept in" into the pursuit of knowledge. As a student of William James, Singer was a product of the pragmatist tradition. However, he went one step further than the traditional pragmatist position, namely, that truth is relative to the attainment of a purpose or goal. According to Singer, only once all possible perspectives have been swept in can we assume that our position is approaching truth or reality. The ultimate truth can never be attained, but according to the pragmatist it can be approached indefinitely.

Ulrich (Ulrich, 1994b:34) explains that the ideal of comprehensiveness is to know all the facts pertaining to the problem before a decision is made. This is not possible and therefore to be truly systemic, we have to acknowledge the fact that our perspective of the problem is incomplete. The Singerian position is therefore that if we do not understand the problem, we can sweep in more perspectives (widen the inquiry) until we do. The ideal is to be comprehensive, but to be pragmatic, decisions eventually have to be made based upon an incomplete view of reality. We therefore have to include into our inquiry the knowledge that the planning may be distorted by this lack of comprehensiveness.

3.1.2 World view

Singer also proposed that all scientific inquiry is based upon an implicit or explicit underlying world view, or weltanschauung of the inquirer (scientist). These assumptions are in effect what is being tested in the classical laboratory. Such world views are shared by

scientists in the same discipline as a paradigm. Kuhn's concept of a paradigm shift (Kuhn, 1962) therefore can be interpreted to mean that a collective world view has changed, with effects on the discipline in the ways described by him. The opposing world view leading to the shift can be taken as an antithesis of a dialectical kind. In social systems the position of the scientist is taken by the planner, whose own world view therefore is being tested during the process of inquiry.

3.1.3 Measurement

The process of testing is subject to error of observation and facts can therefore only be estimated approximately, which is why statistics have such an important role in the measurement and reporting of results. However, the experimenter is still faced with two possible errors: we may reject some assumption that is true (error of the first kind), or accept an assumption that is false (error of the second kind). When efforts are made to reduce the risk of an error of the first kind, the risk for an error of the second kind increases and vice versa. It therefore becomes critical to select the correct hypothesis to test (ask the right question). Churchman concludes that science consists of two parts:

i. Traditional science, which is driven by methodology and its own internal politics, and
ii. Systems science, which inquires into areas more relevant to the common good (social inquiry).

The former is the position that the medical profession would like to be identified with at present.

Science has a theoretical component that is the measurable part, and a value component which is the ethical part of decisions made in the process of measurement. The latter is usually ignored in traditional science.

The dilemma of precision of measurement is that it works acceptably in a "controlled" environment within which results can presumably be predicted. The decision of how to control the environment in itself is not only an arbitrary, but also a value decision, although the traditional scientist may not be aware that this is the case. Furthermore, most scientific data is both theory and value laden and if either component is excluded, conclusions that are made cannot be comprehensive. Most problems of management are vague, for which traditional measurement is ill suited, although the process of measurement is a popular one in modern management science. It is therefore more important to know when to measure than how to measure. This is also the conclusion that Checkland came to in his research (Checkland, 1991:143). Hard systems designs such as systems engineering, systems analysis and the RAND approach, are suitable for well-structured problems. However, most problems where humans are involved are unstructured, and the application of such methods are therefore ill suited for planning in these circumstances. The dilemma of measurement in terms of medical inquiry has been discussed in chapter 4.

3.1.4 Ethics

Singer argued that ethics, in the sense of appropriate goals for a system, could be swept into the decision making process. This means that the importance of the influence of the individual on the system is recognised. Therefore, consideration has to be given to the possibility that the objectives of the study may have unacceptable consequences and that the planner should therefore not participate in it.

3.1.5 Enemies

Finally, Churchman introduces an important concept into his approach to systems, namely the enemies of the systems approach. Much has been said and written about what he meant by this. It is this researcher's interpretation that he meant the enemies to be the antithesis to the systems approach. The best way to see it would probably be similar to the Eastern concept of yin and yang. (This is often misunderstood in the West to mean opposites. In reality it means that opposites belong together and make the existence of each other possible. In other words, without hate there can be no love and without the male, there can be no female, etc., these opposites presenting polarities of a whole. In fact, without opposites there can be nothing at all (Watts, 1975:19; Capra, 1991:118)).

The enemies are the ways that decisions are usually made in real life by non-systems practitioners, and Churchman identifies them as: politics, morality, religion and aesthetics. This is the other (illogical) part of the systems approach, which gives meaning to its existence and without which a systems approach would not have been necessary. The implication is that no systems approach can ever be complete without sweeping in (considering) these conflicting perspectives as well. In other words, in order to consider a problem in its widest possible sense (be comprehensive), one also has to consider how the enemies will attempt to solve the problem. Only once one has considered this can the approach to the problem have been truly systemic.

It is of further importance that the enemies often own or control the resources that are needed for change. They may therefore be decision makers that will determine whether a plan will be implemented or not. Their fears and wishes therefore have to be part of the planning, even though it may be illogical.

Lastly, we have to be aware that because the ideal of comprehensiveness cannot be attained, planning is based upon an incomplete representation of reality. By using the systems approach we hope to make decisions more logically, but the enemies can also question the validity of this position. We therefore have to reflect on the fact that our view of completeness may be distorted in itself (Ulrich, 1994b:224).

The enemies are defined as follows:

- Politics. The way that people gather around communal issues.
- Morality. Ideas about right and wrong.
- Religion. The higher, spiritual (not only in a religious sense) ideals that people aspire to.
- Aesthetics. That which gives beauty to existence.

3.1.6 History of the problem

Churchman feels that a systems approach would be inappropriate if we do not examine the past history of a problem. We can only learn if we start off by having an understanding of the ideas and circumstances that contributed and lead to the current problem as it is. The solution does not start with the problem, but with its history. Furthermore, the solution to the problem will carry within it the seeds for new and further problems which will have to be solved in the future. Churchman sees the learning process as both the discovery of new things and the better understanding of old ones.

In this sense one also has to understand the history of the systems approach or the events that lead to its existence. We can conclude from our philosophical tradition that reason and

observation are the most useful guides for contributing to a better society. According to Churchman, "*Intelligence, reflection, reason and observation, are the highest expression of living beings*" (Churchman, 1979:42). This statement effectively reflects the aims of a learning system (or cycle).

The combination of reason and observation into a common approach is best reflected in the Kantian approach. Kant in essence postulated that what we observe largely depends upon our basic theory (weltanschauung) about the way that the world is constructed.

This problem is illustrated by the historical belief that precision in the measurement of a system necessarily means that a description of a larger system will be precise too. This is a situation with the potential for fatal errors. It is also a belief that is free of a value component. Such systems, based upon the work of Shewhart and the statistical approach of Neyman-Pearson, were used in industry. The latter developed a theory for testing, based upon the assumption of the power of statistical testing. This assumption was a test that would minimise the risk for an error of the second kind for a given probability of an error of the first kind (a test for a given probability for rejecting an assumption that is true, while at the same time minimising the risk for accepting an assumption that is wrong). This theory only has validity in the first instance if the correct hypothesis is being tested. The methods for measuring medical outcomes are mostly based upon this theory. It has been shown earlier that the belief in statistical measurement rests on the predictability of essentially linear systems, in other words systems based upon a traditional cause-effect model.

These approaches further expressed themselves mostly in management science by way of the institution of various techniques to optimise, or minimise, the outcomes of certain human interactions. The answers were usually arrived at through the use of mathematical formulae. This approach expanded its application through the use of computers, which made long-term simulations of human interactions possible. The fundamental problem is that humans simply do not act according to mathematical laws. The enemies of the systems approach see to it that the realities of life cannot be conceptualised, measured, or approximated. (Social systems are essentially chaotic, or non-linear systems. Linear systems are based upon the principle of predictability over a period of time (the Kantian apriori). This means that a small initial error will result in a small error over time, but in non-linear system, a small initial error is amplified logarithmically and the error over time bears no relationship to the original position.) Models and methods such as the systems approach are therefore merely tools to find an approximate representation of reality, based upon the belief that it is a better approach than the other ones mentioned above.

3.2 LOGIC

3.2.1 Truth

No statement or assumption can ever be accepted with complete certainty as being true or false. Churchman therefore follows Kant's definition of logic as being the way that a statement can be justified as being true or false.

3.2.2 Comprehensiveness

A further assumption underlying an approach to logic is the idea that comprehensiveness means that all the facts of nature can be linked together in a comprehensive whole, or fact net. The logic of nature therefore consists of dealing with the whole in terms of the way that these facts are interlinked with each other (structure). If we detect a possible inconsistency in nature, it can be explained by examining it in terms of a richer imagery. In other words, by

sweeping in a more extensive approach to inquiry. This is the fundamental foundation upon which the modern scientific laboratory is based. In other words, it is a place where the facts of nature are searched for and detected, which eventually contributes to completing the puzzle of a complete fact net. Many believe that the ultimate source of all knowledge is God and the assumption is therefore that it is eventually possible to have the ultimate knowledge.

3.2.3 Control

In order to make traditional laboratory experiments possible, the environment in the laboratory has to be controlled. Those factors in the environment that cannot be controlled are either included in the experiment, or removed from the experiment. This means that:

- The hypothesis itself is irrelevant unless it can be tested in a classical (controlled) laboratory.
- The observer in the classical laboratory is considered to be outside the experiment (objective) (observe the experiment from the outside).
- Nature is logical and truthful. An error in measurement is therefore an error of the observer and can be eliminated by reviewing the results, or by repeating the experiment.

The classical laboratory, although imperfect, serves some purpose in examining nature. However, in the planning "laboratory" one deals with humans, and in the process the number of variables introduced become too many and of too complex a nature to control. Planning cannot be separated from society. The difficulty to control has been discussed earlier. Humans cannot be isolated from the environment as in the laboratory, and therefore there are a multitude of variables that cannot be controlled and that may influence the outcome of the study. Furthermore, the outcome is determined by the reports of the humans under study, and it has been shown in chapter 1 that the translation of personal experience is fraught with difficulty of interpretation.

In the classical laboratory, the assumption is that there are variables that the experimenter can control. If this goal cannot be attained, it is assumed that the design of the experiment is defective. In planning, the variables are human, and controlling them introduces an ethical or value question. If the planner or decision maker controls the action of the subjects of the experiment, possibilities in their actions are removed. This impoverishes the possible outcomes of the experiment and also influences the validity of the results. Furthermore, the question is whether it is ethical to control the subjects with or without their consent. An example would be the testing of drugs on human volunteers. They are usually handsomely rewarded and the question is whether this is an ethical position, in spite of informed consent. From the point of view of planners, the source of the hypothesis is of vital importance, and so is their own objectivity.

3.2.4 Methodology

This leads one to an important conclusion, namely that a methodology of problem solving should be invented in which human bias is the central aspect. Such a methodology has:

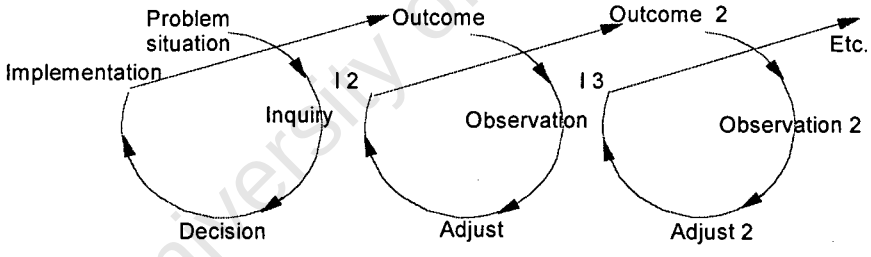
i. A decision maker who has the ability to change things in the environment (controls the means). The result of the change is either the realisation of the decision maker's plans (ends), or the outcome can be unintentional. The important point to note here is that the decision maker's actions may lead to new problems, therefore new means, ends, etc. Planning is therefore a never ending process, in other words, it is a learning cycle. Decision makers can change components of the system under their control, but have to

take decisions within the environment of the problem which they cannot control. Both the components and environment contribute to the improvement of the situation, but only the former is under their control. This is complicated further by the fact that the position may also not be seated in a single person, but may be a complex interaction of various people.

ii. A planner who is the equivalent of the observer in the classical laboratory. According to Churchman, depending on the approach, planning can be either:

a) Problem solving, during which the planner attempts to satisfy the goals (ends) of the decision maker for a fee (also called goals planning).
b) Objectives planning, when there are constraints attached to the solution such as that it should be legal, not damage the environment, etc., but it is possible for the planner to investigate further than the specified goals set by the decision maker.
c) Ideals planning, when the ends of planning are determined by a general ethic rather than by the decision maker.

The systems approach, as an approach to planning, is one of adaptation, learning and correction (follow a learning cycle), rather than an approach for solving sequential problems such as in classical science. The idea is to take a decision on as complete a basis as possible and then to observe the outcome, adjust the hypothesis, implement a change, observe the outcome, etc. It is therefore a long-term, cyclical process (similar to the pragmatist approach). (See diagram 14).



Churchman's learning cycle
Diagram 14

To determine reality, one can use either reason (rationalism) or observation (empiricism). The difference between them is that if some justifiable assertions can be established by reason, a series of other assertions can be deduced and justified (deduction). For observation, reality can only be determined by observation and observation alone. Kant postulated that there are at least two assertions that we have to determine by reason in order to make observation possible, namely time and space. This is the framework that enables observation to take place.

3.2.5 The Churchman methodology

According to Churchman, people are the centre of the planner's reality. In this sense, the systems approach is one of the humanities. His approach (methodology) to planning consists of the following:

i. Clients
   a) Who have a purpose, and
   b) who are the measure of performance (improvement) for the satisfactory achievement of the purpose.
ii. Decision makers
   a) Who have resources (Components of the system. These are aspects of reality that can be changed), and
   b) have an (decision) environment (aspects of reality) that they cannot control.
iii. Planners
   a) How they should implement their plans, and
   b) what should be the guarantor (guarantee) that the plan will succeed.
iii. Systems philosophy
   a) Enemies of the systems approach.
   b) The significance of the whole effort. Has there been betterment?

Churchman never commits himself to a firm methodology, since he feels that his framework is one for understanding the process for comprehending reality. They are therefore not fixed ideas and are always in a continuous state of flux. Since the process of understanding is not a fixed one, it is also not possible to commit it to a rigid system of inquiry and planning. A rigid formal methodology has the advantage of precision, but lacks creativity. A more informal methodology lacks rigor, but has more creative possibilities. The latter is of more importance in an unstructured environment than precision, which is also the position taken by Checkland in his methodology (Checkland, 1981:161). An important point for developing this schema, is to compare the reality of "is" with the ethical position of "ought". In this way a basic framework or map is created. It is also Ulrich's interpretation that Churchman's questions are meant to reflect on the basic philosophy of our planning, rather than to serve as a method for mapping reality (Ulrich, 1994b:247).

i. Clients are people who cannot help themselves. If the starting point is one of who ought to be the client, value questions are introduced, which is why planners usually prefer to start with the simpler position of the purpose of the client. Churchman defines purpose as: *future states of the world, which can be partially shaped by decision making, and which are intended to occur by the decision maker* (Churchman, 1979:82). The approach to the purpose can be:

   - goals, which are short term;
   - objectives, which are longer term; and
   - ideals, which are indefinite.

   In the case of goals, most aspects of the inquiry are given, that is both the client and decision maker as entities and the alternative options of the plan are clearly defined. This is the traditional hard systems approach; in other words there is a current situation and a desired goal. The object of planning is inquiry into different possible ways of reaching this goal. In objectives planning, that which is given is placed within a larger environment and the outcome becomes that which is possible or realistic. In ideals planning, the environment is one in which all restraints have been removed. If this terminology is taken one step further, then the measure of performance for goals planning is the degree to

which the goal or purpose has been achieved for the client. In ideals planning, the measurement includes the potential benefits and cost of the plan (in its widest sense) to the client and society. For the ideals planner, the idea is to improve the human condition (betterment) and a specific measure of performance is therefore difficult to find. In the end, the most reasonable approach to measurement is a pragmatic one, which serves a different purpose for different people.

ii. The decision maker not only chooses a specific course of action, but in the process also decides not to follow a number of other options. In goals planning, a single person or body is identified who will be presented with a menu of options from which one may be chosen. The planner in this case is usually paid to study the consequences of these options and to present a plan that will satisfy the goals of the client. It appears to be important for humans to put the components of life within boundaries. This may serve the purpose of making what we observe more intelligible by putting it within Kant's space and time framework. However, these boundaries are arbitrary. They are also one of the central problems to be determined by both goals and objectives planning. For ideals planning, boundaries have no particular purpose, since it is more concerned with the process of unfolding.

iii. To the planner, the first question is: who ought to plan, rather than who is planning. The fact is that we use our intellect in an attempt to improve our condition. However only a few people have the training and ability to do so. On the other hand, the crucial skill of the planner is to bring together all the people whose expertise is needed to solve the problem (Ulrich, 1994b:256).

An important problem is that expertise does not guarantee improvement. Furthermore, the planner has to reflect on the possibility that the sources of expertise are a possible source of deception.

iv. Implementation is defined by Churchman as: the transformation into action of an intellectually conceived plan (Churchman, 1979:94). This is the area where the planner and decision maker come into conflict. In an organisation there are often many co-producers who operate in subtle and informal ways. (The co-producers are necessary and have to interact constructively for the product to come into being). They often represent the organisation's subconscious, and can interfere with the implementation of plans. In objectives planning, the object is to make the subconscious conscious. (Make mental models explicit). When doing so, the fact that some decisions and decision makers change people's lives and is therefore manipulative, comes into the open. The planner has to be careful not to be perceived as being part of this manipulative process. This perception can be reduced through participative planning. It is an uncomfortable fact that many plans will never be implemented (Stacey, 1993:39). The goals planner experiences this as an inability or unwillingness of the decision maker to implement plans, but the objectives planner experiences this as part of the investigation into the problem. In other words, the reasons why the plan cannot be implemented are part of the planning inquiry. One of the reasons for plans that are not implemented may be found in research that Churchman did and which found that people tend to be more comfortable in communal decision making, rather than making decisions individually. The explanation for this may be the preferred cognitive styles of people (Kirton, 1989). The implication is that social groups tend to seek stability and therefore gravitate towards an adaptive style, in other words communal decision making (Van der Molen, 1989).

This raises an important issue which has never been raised explicitly by Churchman, namely that of responsibility. (Responsible - *liable to be called to account; morally*

accountable for one's actions; capable of rational conduct (Allen, 1992)). The traditional concept of responsibility is based upon the assumption that a person or persons control the resources and variables to produce a particular output . This position is based upon the traditional linear concept of causality. In complex systems, a non-linear environment is operative in which the traditional causality model is meaningless. The magnitude of complexity of such a system is such that no individual can hope to control it. Therefore, responsibility in a complex non-linear system has no meaning.

3.2.6 Boundaries

The boundaries of planning for the goals planner stop at the boundaries of the problem, and for the objectives planner at the boundaries of feasibility and responsibility, but for the ideals planner there are no limits. For the objectives planner, boundaries have to be set for the investigation of social systems, since otherwise the planning process can never reach a point of implementation. For ideals planning on the other hand, the major task of planning is to learn enough about the consequences of intervention to ensure "control" over the intended changes. Recommendations and implementation may occur as sources of learning.

Churchman did not explore this very important theme any further and what follows will be Ulrich's interpretation of his position on it (Ulrich, 1994b:225,247).

Whenever a systems approach is applied, strong assumptions are made about what belongs to the system under investigation and what is part of the environment. These judgements are boundary judgements. It is of vital importance to realise that these assumptions are judgements made by the planner and do not reflect reality. In many modern planning methodologies, attempts are often made to define problems to suit the methodology, instead of the methodology being a tool for the better understanding of the problem. Such an approach leads to problems with boundary judgements.

According to Ulrich, boundary judgements have to be made in terms of:

- The boundary between the system under study and its environment; and
- The selected system between those people who are affected by the potential outcome of planning (who have to live the consequences of planning) and those who are involved in the planning process through their ability to contribute resources.

This leads to two important questions namely firstly, what belongs to the problem and what to its environment, and secondly, how to draw the boundary between the involved and affected. Within this framework planning is influenced by:

- The client, who serves as the source of motivation (values).
- The decision maker, who serves as the source of control (power).
- The planner, who serves as the source of expertise.

These three basic sources of influence constitute the involved. The affected are those who will have to live the consequences of the plan, but who do not influence the process of planning. The affected and involved together constitute the social system to be bounded.

3.2.7 Objectives versus ideals planning

A fundamental difference between objectives and ideals planning is that the former is contracted to a client, whereas the latter will invariably go beyond the intentions of the

contractor. The objectives planner is morally and legally constrained in the planning, the ethical choice being only whether to accept the conditions for working for the client or not. The ideals planner strives for the betterment of humanity, who is therefore the client, and planning and boundaries are therefore not constrained in any way. According to Churchman, the ideals planner determines the ideals for planning for humanity based upon an own theory of the value-evolution of humankind. This theory states inter alia that the conditions for the improvement of humankind cannot be known, but all the supposed conditions can be studied and questioned. The way that Ackoff implements ideals planning, does not fully satisfy Churchman's view. Ackoff's position is more that of the determination of possibilities rather than the explicit betterment of mankind.

For objectives planning, common sense is often used to avoid investigation of options that are clearly undesirable (illegal, immoral, etc.). In ideals planning, all options have to be studied, including those that would normally be avoided by common sense, since otherwise the learning process may not be complete and the inquiry is not comprehensive. The implication of this is that it is logical that sometimes the implementation of the nonsensical solutions of the enemies of the systems approach may be preferable, in order to improve humankind. As suggested earlier, the enemies are therefore the antithesis to the systems approach. The dialectic approach is the most powerful method for questioning world views and therefore for learning to take place.

3.3 PARTICIPATIVE PLANNING (Ackoff, 1981:44,65,116)

Although participation is only mentioned in passing in *The Systems Approach and Its Enemies*, it is fundamental to the concept of comprehensiveness and therefore to a systems approach to planning. The idea is that through participation clients are enabled to help (empower) themselves, and even more importantly, how to learn to do so continuously.

The fundamental position is that in ideals planning of a system, every stakeholder in the planned situation has a potentially important contribution to make, since in this situation no-one can be an expert. The clients in such a system know better than the expert what is needed and possible. Ulrich's position is that the planner as expert only acts as a facilitator for the process of inquiry. In addition, as a result of their participation participants develop an understanding of the system and its interactions, the way that decisions are made and how their actions affect the system. Participation therefore leads to learning and personal development (Ackoff, 1981:44). Furthermore, participants are able to build their own ideals and values into the design. Participation goes a long way towards solving the problem of implementation by the members of the system.

3.4 ETHICS

Ethic: *a set of moral principles.*
Morals: *a) Concerned with the goodness or badness of human character or behaviour, or with the distinction between right and wrong, b) concerned with accepted rules and standards of human behaviour* (Allen, 1992). Ethics can therefore be defined as: *a set of principles to distinguish between right or wrong, or a set of principles for accepted rules and the standard of human behaviour.*
Value: *one's principles, or standards; one's judgement of what is valuable or important in life.*

The discussion on ethics is fundamental to understanding Churchman's approach to ideals planning. His position is that modern works on systems analysis, planning, operations research, etc., all suffer from a poverty of attention to ethical issues (Churchman, 1994).

Ethics is (and has to be) a continuous dialectical process of discussion and debate. This is the way that a value component is added to decision making by the Singerian system. The ideal and reality are dialectical positions that are part of the same inquiry, and therefore both have to be considered to make a systems approach valid.

His development of this position is firstly by using the work of Bentham, who postulated pain and pleasure as the fundamental sources of all human values. In other words, pain and pleasure are the principles by which ethical values are decided upon. The work of Kant sweeps in moral law, which according to him is a precondition for happiness. According to Kant, if you can tolerate the burden (take responsibility for) of having your vision become a universal law, then your vision and moral law is moral. Morality is therefore based upon ensuring that all humans shall be treated fairly. (Do unto others). This does not mean that everyone shall be treated equally. In other words, to adapt Milton Friedman's idea of capitalism, all humans should not end the race of life at the same time, but they should be given the opportunity to start it on an equal basis.

If a hypothetical position needs the input of an expert to solve it, it is a technical question. But if there is no precondition to the question, in other words it is a categorical one, everyone can decide on it, and it becomes a moral problem. In other words, there are no experts on morality. Those that are affected by decisions therefore have the highest moral expertise to help decide the question.

This raises a further question, namely that of the fundamental opposition between individual and social ethics. According to Carl Jung, the individual strives to individuate himself, in other words become integrated with himself. According to Churchman, the implication of Jung's position is that it is necessary for individual morality to be complete before social morality can exist. This position is a continuance of Kant's idea of ethics and is also fundamental to the religious philosophies of Christianity and Buddhism in particular (the bottom up approach). The antithesis to this is that if social ethics can be extended far enough, it will provide a framework for the development of individual morality, and the need for individuation on an individual basis will disappear. This is the position of Churchman's mentor, EA. Singer (the top down approach). This means that a collective morality enables individuals to individualise themselves more comprehensively within a moral system. Or in terms of Maslow's hierarchy of self (see chapter 1), it becomes possible for individuals to realise their full potential in a system mature enough to create an environment that will enable them to do so.

These dialectical opposites are also reflected in the social sciences. On the one hand, there is fundamentalism that concerns itself with the study of social facts as the emergent properties of social groups. On the other, there is the action approach that is concerned with the action of individuals and their effect on the behaviour of others. It is a peculiar fact that the former position is associated with positivism (empiricism) and the latter with phenomenology (rationalism-metaphysics). In a sense, Singer's position is then a continuation of the latter position, although his point of reference is society as a group.

For Singer, the good, or morality, must be found in our purpose, in other words, goals or ends. In this sense ends are goals that can in principle be attained. Ideals[51] are unattainable but can be approximated indefinitely. It follows then that the answer to any meaningful question is an ideal and that reality is always an ideal. Since we are purposeful as human beings, we seek to attain goals and to do so we also want the power to realise these goals. The activities that improve the chances of reaching the goals (empower the goal seeker) are: the

[51] Ideal - *answering to one's highest conceptions* (Allen, 1992).

means at the individual's disposal, knowledge, and co-operation with others. Accordingly, these activities are a summary of Singer's concept of power.

Singer's position, then, in the end, is that individual morality gains its meaning in the context of service to mankind, in other words that service to other humans is the highest ideal.. This is the state that Churchman calls heroism (hope). The implication of this state is a belief that we as humans do have the ability to improve our destiny.

Churchman's position of heroism is perhaps one of the most difficult of his ideas to understand. Different authors have different interpretations of what Churchman means by this. Churchman has explained in a class[52] that he understands ethics to be the rational consideration of what is right and wrong, and morals the emotional judgement of what is right and wrong. Morals and ethics would therefore represent two aspects of a dialectical position which can be synthesised into a concept of betterment.

Ulrich (Ulrich, 1994a) understands heroism to mean the evaluation of the costs of implementation of planning to the affected. Accordingly, the possible effect of the plan on the future of the affected has to be swept into the inquiry. This leaves the question of the measurement of improvement. Traditional ethics is inadequate as a measure of improvement of the whole system, because it relies on the moral and ethical judgement of individuals. Moral action is therefore identified in terms of individual action. The ethical question therefore has to be understood in terms of the total system. To be systemically ethical, the "expert" (planner) has to be knowledgeable in terms of the design, those who will be affected in the future (the unborn), and the harm that improvement may cause to the system as a whole. The challenge then becomes to assist the affected (client) into participating in making moral and ethical judgements. Since it is not possible to make binding moral judgements, the best we can to at present is to inquire into the deficiency of moral justification.

Ackoff (Ackoff, 1981:40) elaborates on Singer's concept of aesthetics. According to him, the aesthetic function is to inspire us to create visions of improvement and give us the courage to pursue it. This means that we must always find new possibilities for progress and therefore we have to continuously create new visions for improvement. This explanation in many ways echoes Churchman's position of heroism.

3.5 INTERPRETATION

Churchman's approach can be summarised as follows:

i. The purpose of management is to plan the improvement of a current situation.
ii. The process of planning is an ethical pursuit, and the purpose is therefore improvement for all mankind (betterment). Planning is consequently based upon the attainment of ideals and the ethics of whole systems.
iii. Planning is an intellectual (conscious) process by which we try to secure[53] improvement.
iv. Improvement is only possible if the totality of the conditions that will determine the quality of our decisions is considered (comprehensiveness) (Ulrich, 1994a). To ensure comprehensiveness, one has to:
    a) Inquire into the whole system; (in other words the approach has to be systemic);
    b) Include the views and ideals of all those affected by the plan; and
    c) Consider the possible cost of the implementation of the design to those affected by it.

[52] JP Strümpfer, personal communication.
[53] To secure means that the improvement persists in the larger system over time. Churchman, quoted in Ulrich (Ulrich, 1994a).

v. The process of inquiry has to sweep in more and more aspects from the environment in order to be comprehensive.
vi. The starting point is identifying the events that have lead to the current situation, in other words, the history of the problem. Different methods are used to inquire about the problem and acquire the necessary knowledge about it. These are:

a) Fact nets: What are the basic truths and how were they used to construct the identified knowledge?
b) Empirical inquiry: How was agreement reached about the validity of the basic truths?
c) Synthetic inquiry: What are the assumptions made from which the knowledge is derived?
e) Dialectic inquiry: What are the different view points of which the knowledge is a product?
f) Ethical inquiry: What is the value implication of the knowledge?

vii. We cannot design improvement without assuming some theory of the nature of the relevant system (Ulrich, 1994a). To be systemic, we have to reflect on the shortcomings and deception that this imposes on our planning effort.
viii. The crux of the approach is to view the problem from different perspectives in order to improve comprehensiveness. The problem is therefore observed in turn through the eyes of the affected (client), decision maker, and planner (expert). The problem is viewed both in terms of the current situation and the desired outcome.
ix. However, the ideal of total comprehensiveness cannot be attained. Because inquiry will always be incomplete, plans will have unforeseen results. We consequently have to be prepared to consider these possible outcomes and when they occur, must repeat the cycle of inquiry to enable further improvement. The approach is therefore based upon a perpetual cycle of inquiry or a learning system.
x. The inquiry also has to sweep in the perspectives of alternative approaches (its enemies) in order to be comprehensive.
xi. Lastly, the planner should inquire about the significance of the implementation of his plan. Management implies judgement about the needs and cost of implementation for the affected. An understanding of the consequences of our actions and omissions may be the only way to secure (guarantee) improvement that persists over time. We have to ask ourselves whether the plan will contribute towards the betterment of mankind in an ethical way (Churchman, 1994).

3.6 CONCLUSION

In his writings, Churchman does not commit himself to a rigid methodology, but this in itself creates a method that is immensely powerful and robust, since it can be moulded to suit any particular situation. In this way it avoids the danger of the rigidity that is typical of some systems methodologies and which inevitably leave them with deficiencies when they are not applied to suitable problems. By problems is meant the dilemmas pointed out in Flood and Jackson's grouping of systems methodologies (Flood and Jackson, 1991:31). For example, they feel that there is no methodology available to address what they call complex-coercive problems. Churchman's work can be interpreted to mean that addressing the enemies does just that. The shortcoming is not in the methodology, but in the fact that certain aspects of human nature cannot be altered systemically or otherwise. The search for a systems approach to do so is inevitably doomed to failure.

Churchman's work makes an important contribution to our understanding of the process of inquiry. The principles identified in this chapter are therefore suitable for addressing the problems identified in the patient-physician interaction in the previous chapter. In terms of

the argument thus far, the world view of health care of patients and physicians contributes towards the inefficient functioning of the health care system. If this image can be altered, the needs, wants and expectations of patients and physicians may change, which in turn may improve the patient-physician interaction. Churchman's approach to inquiry is imminently suitable for testing the assumptions upon which all decision making is based and in particular non-empirical decision making.114 On the other hand, it is also a powerful method for improving the quality of empirical decision making based upon available medical knowledge. In the next chapter, Churchman's concepts and methodology will be used for an inquiry into the assumptions upon which the prevailing world view of health care, as well as medical knowledge is based.

CHAPTER 6

A PROCESS THAT MAY LEAD TO BETTER DIAGNOSIS AND TREATMENT AND DECREASED COST

The findings of the study until now has been the following:

- The health care system is a complex social system.
- Historically, this system developed from a simple into multiple complex interactions.
- Health care thinking is still in terms of simple linear causal interactions.
- The patient-physician interaction is the basic interaction that sets into motion the processes that will eventually determine cost. This interaction is determined by the needs, wants and expectations (ends) of both patients and physicians on the one hand, and available knowledge and skills (means) on the other hand. This enormously complex interaction could be improved by the application of an approach that can increase the ability of patients and physicians to understand how their actions affect the system. This knowledge may lead to alignment of their images, learning, and a more efficient system. Furthermore, such a system of inquiry may improve the knowledge, skills and decision making of physicians with added efficiency.
- C West Churchman studied the design of inquiring systems. His general systems theory is an excellent model for achieving the goal of improved decision making and therefore increased learning and efficiency in the patient-physician interaction.
- The rest of this chapter will be devoted to exploring the possible effect of an application of aspects of Churchman's work to the health care system. The focus will be the two areas identified in the patient-physician interaction, namely:

  i. the world view of illness and health care, and
  ii. the efficient use of available medical knowledge.

The question to be answered in this chapter is: what can be done about the problem? As the point of departure, the purpose of the health care system has to be explored. In chapter 1, the health care system was defined as: a system that looks after a person's mental or physical condition. This definition was broadened in chapter 4, where health care was defined as: a state of being, in which individuals do the best they can with the capabilities they have, and act in ways to maximise their capabilities. Furthermore, it was determined that the patient-physician system is a system where patients consult physicians (who are professionals by virtue of their special knowledge and skills), about changes in their physical or mental conditions. Therefore, the purpose of patients is to have these changes restored or altered to their satisfaction and the purpose of the health care system to assist them to do so.

1. The health care system as a purposeful system

In terms of a social system metaphor, the health care system needs to change to better reflect its purpose. Purpose has been defined as the ability to select own objectives and the means for pursuing them. The focus of this study is the patient-physician system of which the purpose is:

- The purpose of the patient-physician system itself.
- The purpose of its parts (patients, physicians, hospitals, administrators and pharmacists).
- The purpose of the health care system of which it is a part.

1.1 PURPOSE OF THE PATIENT-PHYSICIAN SYSTEM

The objective of the patient-physician system is to maximise the physical and mental capabilities of patients, to enable them to function as efficiently as possible. Patients select physicians as the means for achieving this purpose, and physicians in turn, use hospital facilities and pharmaceuticals as means, in addition to their own knowledge, experience, and skill, to assist patients in achieving their objective. Furthermore, patients who are economically advantaged enough may have medical insurance that ensures the financial means with which to pay for the use of means necessary to achieve their objectives. In terms of purpose, the selection of the correct means, in other words the right physician, has particular importance. In other words, it becomes important to find that physician who will be the best able to achieve the purpose, given the environment within which the decision takes place (ability to pay, availability of physician pool, etc.).

1.2 PURPOSE OF PHYSICIANS

The purpose of physicians, in terms of the health care system, is to serve as the means for returning patients to a physically and mentally well state so that they can live their lives to their full capacity. However, physician behaviour is often determined by their own personal wants and needs. Individual ends may be personal need satisfaction (see chapter 1), such as financial success, or professional credibility. Traditionally, these ends are subservient to patient needs and are therefore unstated. However, the social laboratory is not value free and the values of physicians as planners ought to be considered in decision making.

1.3 PURPOSE OF PATIENTS

There does not appear to be a clear idea of the health care ends that patients (or society in general) desire. Ends can be divided in needs (that have to be fulfilled), and wants (that do not). In terms of Churchman's approach, ends could be goals, objectives, or ideals.

- Needs. Purpose in terms of needs is to maximise capabilities, hence to have illness or disability restored to a state where it becomes possible to function socially in an acceptable manner. If needs are not restored, disability, disfigurement, or death may occur. The satisfaction of needs therefore is usually a goal. However, need satisfaction can also be an objective or ideal, when measures are instituted to prevent illness from occurring, such as vaccination, efforts to stop smoking, a healthier lifestyle, etc.

- Wants. The dilemma is in terms of wants, the attainment of which is not a necessity. The wants of patients are shaped largely by their expectations, which in turn are shaped by their contact with the environment (the lay press, experience of the systems, etc.). Wants could be a goal, for example the desire to have a small upturned nose, which may be satisfied immediately if the necessary means are available. More significant is a prevalent world view of health care, based upon a deterministic model. It assumes that in time science will be able to offer society a world free of illness, pain, deformity, disability, ageing, and maybe eventually even death. These wants are often reflected in the ideals of patients and are represented in the demands identified as contributory to the health care crisis in chapter 2.

This study, on a number of occasions, has shown the deterministic world view to be based upon reductionistic linear causal thinking, a model identified as inappropriate for addressing the complexity of illness and health care systems. Furthermore, this world view assumes the ability to fund wants indefinitely, and in addition is value free, in other words, does not consider the possibility that it may not be desirable to have wants fulfilled. The study has shown that both wants (demand) and limited funding contribute to the crisis in health care. The satisfaction of wants in this case is an individual pursuit and the attainment limited by a resource, namely funding. The result is a village commons problem and to solve the problem, the competitors (patients) will have to co-operate. Therefore, communal needs and wants and the resources available for their satisfaction will have to be determined and balanced with individual wants.

Furthermore, there is an overlap between needs and wants and the dilemma is: Who determines whether the purpose is a need or a want? It is in this area that modern bio-ethics have become disorientated, as discussed later. There is an underlying tension in health care where, according to the definition of purpose, the freedom to choose ends comes into conflict with the ability to do so.

This could be solved if the health care system is conceived as a complex social system. If all the participants in such a system share a similar world view of health care, self-alignment becomes possible, which could lead to improved knowledge of the system and therefore a resolution of the needs-wants dilemma. The next section will explore this proposition.

2. The patient-physician system as a learning system

The objective of group learning is to test shared images and assumptions, and in the case of the patient-physician system, the most important assumption to test is that of the world view of illness and health care. The reason for this is that this will make the roles that patients and physicians play in relation to the system more explicit, and they will therefore be able to recognise the effect of their actions. The fact that they affect the system in a negative way has been identified as a key cause in the health care crisis. The overall objective of group learning, therefore, is to achieve aligned self-control of the individual parts of the system, something which becomes possible through the experience gained from a process of inquiry, and the creation of a shared vision of the organisation. Furthermore, such a process by definition leads to learning (see chapter 1).

An example of a shared vision is the world view of health care, illness and professionals, shared by patients and physicians. The current paradigm has been identified as the product of the history of the health care system, based upon a simplistic linear causality model of illness. The question is: What would happen to the patient-physician system if this world view could be changed ,and how would that influence the processes in the system?

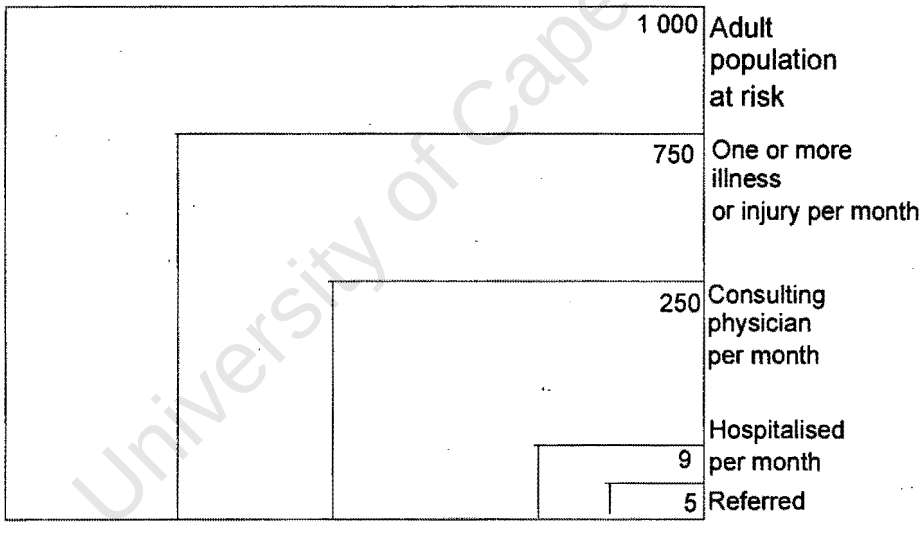
2.1 A SYSTEMS MODEL OF ILLNESS[54]

In terms of a systems approach, it would be appropriate to consider other candidate world views of health care and illness. For the purpose of this dissertation, a different world view will be established based upon the following assumptions:

[54] The work presented here is part of conceptual work done for the CARECorp Managed Care Organisation. The purpose was to develop a new model for the integration of specialised care into a managed care model.

- Illness cannot be eradicated from society, it can only be transformed into a different form.
- Illness can only be defined in terms of a complex biological system with multiple factor circular causality.
- The treatment of illness takes place within a complex social system.
- Intervention in the health care system becomes possible based upon a world view that recognises the complexity of illness and its treatment.

A study of the prevalence of illness in two different communities was published by White et al. (Quoted in McWhinney (McWhinney, 1989:28)(see diagram 15)). This study showed that out of every thousand adults in the population, 750 will have symptoms of illness (being unwell) during a month, but only 250 will seek medical care. Nine will be admitted to hospital and 5 will be referred to another physician. The implication of this study is that the majority of people in the population will have some symptoms of unwellness, such as a sprain, a cold, headache, mild depression, etc., from time to time, that does not require professional care. Furthermore, it means that the largest number of "ill"[55] people are inside the community and are therefore not part of the traditional health care system, and also that the community can effectively deal with them without interference from the medical community. These patients only become a part of the health care system when measures to cope with them within the framework of their social environment breaks down.



Prevalence of illness and utilisation of medical resources among 1 000 adults in the USA and Great Britain (White, Williams and Greenberg: In McWhinney (1981)
Diagram 15

2.1.1 Vickers' model of health care

A similar theme was developed by Vickers (Vickers, 1984). He distinguishes:

- Community medicine.
- Environmental medicine.
- Inpatient medicine.

[55] Illness here is equated with being unwell.

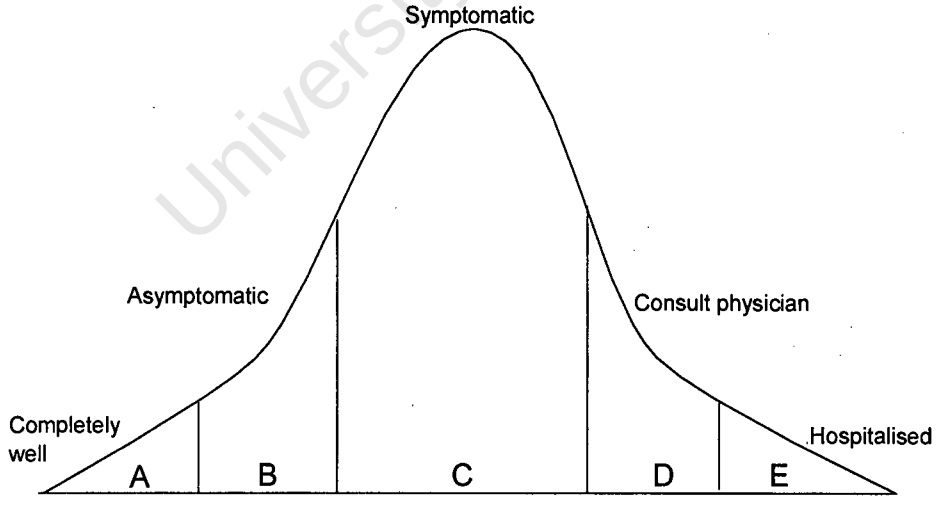
The former has to do with all the resources for managing illness inside the community; inpatient medicine with the resources devoted to caring for illness in hospitals; and environmental medicine with the resources used for the prevention of illness caused by the environment. According to Vickers, the purpose of inpatient medicine is to return the patient to the community for self care as soon as possible. Illness has an effect on systems in the community, such as the family, employment, etc. This means that the ability of the community to deal with illness depends on its ability to deal with the circumstances causing the disturbance. The role of community medicine therefore is to increase the ability of the community to deal with the circumstances surrounding illness.

Vickers' model implies that the selection of candidates and the curriculum for training physicians ought to be altered to reflect the principles of the model. The world view of physicians and patients therefore will have to be altered.

In terms of these two models, the total health care system in reality only deals with about a quarter of the total community, and the specialist system with about 10%. However, the current illness paradigm is focused exclusively on the group of people within the hospital-consultation (inpatient medicine) system. In other words, the environment of the problem and the structure and purpose of the system is ignored completely. This leads to a world view that assumes that hospital based health care is good quality care.

2.1.2 A systems model of health care

White et al's data can also be graphically illustrated on a bell curve (see diagram 16). The interpretation of this curve and the distribution of patients on it is a basis for a comprehensive world view of health care. This model will be presented as the dialectic alternative to the current health care paradigm, and it will be shown how the application of this model could affect the health care system in general.



A model of illness in society
Diagram 16

The approach is based upon the concept of ideals planning, in other words how the health care system ideally ought to look. It furthermore assumes that illness can not be removed

from society, but that the illness profile can be altered. In terms of this curve, illness in society can be visualised as consisting of a spectrum ranging from the perfectly healthy to the terminally ill. It becomes difficult to determine at exactly which point the patient passes from healthy to ill and the exact point is probably irrelevant. What matters is how and why the patient moves along the scale from health to illness and back. In other words: Why can society no longer deal with the problem by itself (by transferring it to the health care system), and how does the health care system cope with the problem in terms of its purpose?

The causes of illness will be assumed to be based upon a complex causality model with numerous interactions and feedback between multiple co-producers. This implies that illness is a highly complex system of interactions and that this should be reflected in treatment. Accordingly, it is more important to see the physician as a manager of the complex problem of illness, rather than an expert in control of a simple problem. The concept of the physician as a manager of illness will be discussed later in the text.

The interpretation of the curve is as follows: Approximately 25% of the community is healthy without symptoms (groups A and B). Of these, about 10% are in perfect health (group A), and the remainder are asymptomatic (group B), in other words they wear spectacles, have minor congenital abnormalities, smoke, bungee jump, etc. Group C represents the 50% of the population that have minor symptoms that require no treatment, or that can be dealt with by self-medication. The last 25% (groups D and E), constitute patients in the health care system, in other words that society is no longer able to deal with without professional help. The question then becomes: Why did patients progress from A to D/E on the illness continuum, and more importantly, how can they be assisted back into the self care group (C).

The purpose of the patient-physician system in the systems model is to assist patients to move from the symptomatically ill group to the symptomatic well group as efficiently as possible (Vickers, 1984). In the traditional health care system, family practitioners and specialists are assumed to be a single group of physicians. In this model, the two groups are separated and the purpose of the specialist becomes to move the hospitalised patient (group E) as efficiently as possible to the non-hospitalised group (D), that is, to the care of the family practitioner. The effect of this is to create a physician network, and the result is an altered physician referral system.

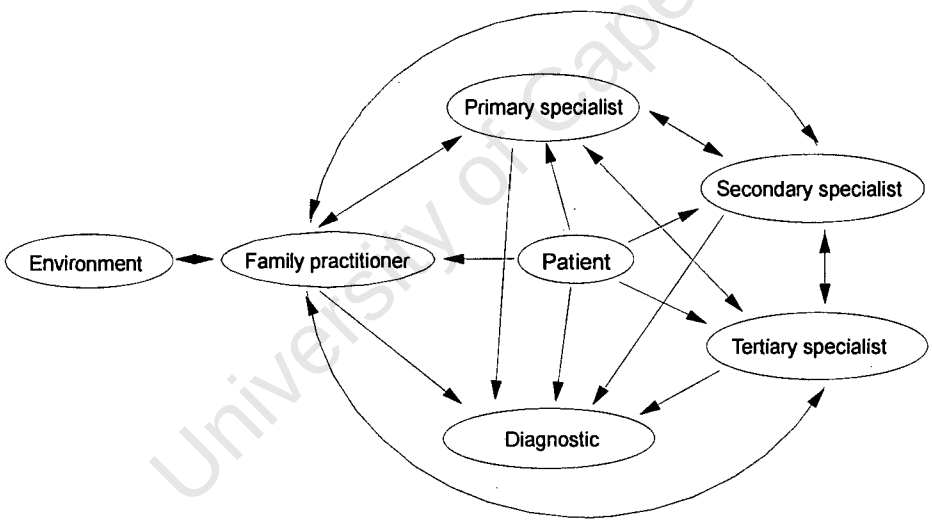
2.2 THE PHYSICIAN REFERRAL SYSTEM AS A NETWORK

The role of the specialist is compatible with Vickers' inpatient medicine, and his suggestion that the training of this group of physicians ought to concentrate on traditional illness (traditional medical training), makes sense in terms of this model. The fundamental redefinition is towards the role of family practitioners. In this system they become specialists in their own right (Rakel, 1990) and ought to be trained to fulfil this purpose[56]. Instead of being the barrier (gatekeeper) between hospital and community medicine, they now have an important role as facilitators. Their purpose is to connect to the hospital system as efficiently as possible and to receive back the patient into the community and continue with the treatment commenced in hospital until the patient is symptomatically well. (They become community physicians in Vickers' terms). The crux of such a system is a continuous and efficient flow of communication (Rakel, 1990). The referral system changes into a network and is no longer a linear system (see diagram 17). The network becomes a purposeful community of physicians (a physician system), rather than a community of separate individual professionals. The change is towards professional teams who have a better chance

[56] They become the bridge between hospital care and the community.

to reach agreement on appropriate protocols and can develop more efficient routines (Teisberg and Porter, 1994). Teams will be able to define protocols appropriate to a particular area and the facilities available to it, rather than having it determined by a bureaucracy who do not have to implement it. In this model, purposeful interaction becomes a necessity and could lead to the testing of communal assumptions and therefore group learning (see chapter 1). In other words, this model alters the physician system into a complex social system as well as a learning organisation.

A network has the potential to break down the barriers of communication between physicians, as well as patients and physicians, if the health care system can be seen to act as a purposeful entity assisting the community. Furthermore, the function of the network in a way becomes an economy of scale model. This means that the specific location of family practitioners is less important than contact with their communities and the network (which is also owned by the community). It may be that this will encourage a more equitable distribution of FP's. In this model, patients do not necessarily have to be referred to specialists, but specialists have an obligation to refer patients to family practitioners for bridging care. They therefore have a duty to ensure that family practitioners have sufficient knowledge and information to continue treatment. A requirement of a network is a recognition of the status of family practitioners as community specialists, as well as the need for mutual trust. This may resolve the present conflict between family practitioners and specialists.



The physician network system
Diagram 17

In terms of the systems model of illness, the role of community medicine, primary health care, and non-traditional medicine, is relevant in regard to the prevention of illness. In other words, in this model their purpose is to prevent people from moving from left to right on the axis by attending to those factors in the environment that can help to prevent people from falling ill (groups B and C).

The model suggests the role of government, as the major role player in preventative medicine and primary health care, as ensuring that patients in groups B and C stay healthy. In other words, they have a responsibility to implement measures to improve the health of society as a whole. This would be represented by Vickers' environmental health. The role of non-traditional medicine in terms of this model is to support self care to patients in group C. In

other words, in the traditional health care system these groups are often in conflict with the patient-physician system, but in terms of the alternative world view, they have a particular role to play.

2.2.1 Information network

A very important result of a physician network is that it creates an information network. This in turn has implications for the implementation of learning systems in health care, and the distribution of knowledge. In some areas there are no medical schools or medical libraries. Consequently there is a minimal exchange of information academically or otherwise between physicians. And yet, there are numerous specialists, each with a large amount of learning, experience, and personal libraries filled with textbooks and the latest journals. The question is: How can this knowledge be accessed? The answer has to be found in the breaking down of barriers to communication. The redefined purpose of specialists includes a vital role in an information (knowledge) network. In such a network, they can be consulted to act purposefully not only towards the resolution of illness, but also as the disseminators of knowledge. Furthermore, the role of the specialist becomes important (in Vickers' terms) to research more effective treatments (traditional research) and also to act as a measure of how well preventative measures have worked to prevent illness progression towards the hospital system (Donaldson, 1992).

Rutstein (Rutstein et al. 1976), described an interesting method to measure exactly this sort of outcome. It is based upon the principle that:

- Quality is the effect of care on the health of the individual and the population as a whole, and is therefore concerned with outcomes.
- Efficiency is an index of how well the health care system is functioning, and is therefore concerned with process.

For the purpose of this method, illnesses are grouped into three classes based upon norms agreed by "experts" in the field.

i The first group represents those illnesses that ought to be investigated as indicators of quality and health when a single case occurs. The illness that occurred caused disability or death, because it was not prevented or treated properly.
ii The second group concerns illnesses that lead to investigation when more than one case occurs, in other words there is a pattern of illness as a result of inadequate prevention or treatment.
iii The third group includes illnesses of which the effect on quality and efficiency is not yet known and therefore need further study.

If a single case of illness from i. occurs, it may be an indication that preventative measures have failed (inefficiency), or that poor treatment was given (quality). If a number of cases of illness listed in ii. occur, it is either an indication of failed measures to prevent this type of illness, or incorrect treatment. Insufficient information is available about diseases in iii., and more data is required before their significance in terms of outcomes can be determined. This approach may be more relevant for monitoring the efficiency of health care than the medical audit discussed in chapter 4, and in particular is appropriate to the systems world view of health care.

In principle, measurements of outcome are measures of performance. Hence, its purpose is to act as a measure of whether patient ends have been successfully achieved. In terms of the earlier discussion, Rutstein's approach is an excellent measure of need fulfilment, or in other

words, the success with which the patient's purpose is achieved within the system. Therefore, it can determine whether in a systems model of health care patients have been prevented successfully from moving towards symptomatic illness, and whether the system has been successful in returning patients to the asymptomatic group. It will be less successful as a measure of wants fulfilment, since this is determined by patient satisfaction.

The problem with traditional measures of performance, such as audit, is that they are concerned with medical outcomes. They are measures designed upon an assumption of simple linear causal interactions and are therefore appropriate for application in systems based upon mechanistic or organismic metaphors. Therefore, they may have application as measures of performance of process, but fail as measures of performance of whole systems.

2.2.2 Communication

The concepts of a physician network and a shared vision of health care, have the potential to break down the barriers to communication between physicians. Such networks may be constructed in the following ways:

- Managed care organisations are in a position to contract only those physicians who show a commitment to the principles of a shared vision (Kronick et al. 1993). At present, physicians are selected based upon the identification of efficient utilisation practices. This criterium has shortcomings as regards implementation (Milstein et al. 1989). The role of managed care organisations in contracting selected physicians is a contentious issue since it may lead to rationing and the loss of some high-technology treatments. However, it also ensures that only those individuals with a commitment to learning and self-alignment will be part of the organisation, with an opportunity to implement planning and to proceed according to the objectives identified.

- A commitment to the exchange of knowledge and a commitment to learning (Rakel, 1990) is a fundamental principle without which the suggested world view will be difficult to implement. Specialists who learn so that they can use their knowledge and experience more efficiently, have a responsibility to share their knowledge with family practitioners and other colleagues. This can be done through personal contact, which in turn may lead to improved interpersonal communication and familiarity. These exchanges may therefore break down the barrier of anonymity (Balint, 1986) and could serve as a basis for the development of mutual respect and also an understanding of the role, purpose, and the effects of decision making that each actor has on the system as a whole. In other words, it should satisfy the conditions for participation (Milstein et al. 1989). The result may be closer co-operation between physicians and subsequently better practice (Rakel, 1990). This ideal can be achieved through clinical discussion groups or lectures, and the requirement that physicians who participate in the system should obtain a minimum number of attendance credits, in order to ensure their continued participation in the system.

- Traditionally, medical practice is done in great secrecy. To a large extent the legal requirement of patient confidentiality shapes this attitude, and it is also reinforced by the regulations of medical councils (an interpretation of the value system of the profession). The result is suspicion and a lack of communication. Studies have indicated that showing physicians how their practices compare to the average patterns for a geographic area or speciality, is more effective in changing practice patterns than general education (Milstein et al. 1989). Such comparisons must be presented free of value judgements. The implication is that this helps physicians to form an understanding of how the way they

practise influence the system, and a way to do so is by creating transparency. In other words, by breaking down the traditional barriers to communication.

In summary, in this section the prevailing world view of health care was challenged by an alternative. The latter is based upon a profile of illness as it occurs in society and may therefore be a better reflection of reality. The application of such a world view affects health care in the following ways:

i. Shared beliefs about health care are changed into a more comprehensive (systemic) image.
ii. The health care system is altered into a complex social system based upon shared vision and understanding.
iii. The role of physicians is redefined in a community of physicians of which the purpose is to manage illness as a complex biological and social problem.
iv. In a physician network, knowledge is utilised more efficiently.
v. This world view is more conductive to learning than the present system.

3. The patient-physician system in terms of the Churchman methodology

The discussion in this text followed Churchman's cycle of inquiry. It started off by identifying a problem, namely an inefficient health care system, of which the symptom is an imminent exhaustion of funding. An inquiry into the causes and history of the problem was then undertaken. A possible solution has been identified as a result of the inquiry, and the next step will be to inquire into the implications of this solution by the use of Churchman's methodology. This will indicate some of the measures that may facilitate the implementation of a systems model of illness and health care.

3.1 CLIENTS (The source of motivation)

The client in Churchman's approach, is a person with possible futures that may be attained. In the traditional patient-physician system, the following clients can be identified who benefit directly from the patient-physician interaction (Teisberg and Porter, 1994).

- Patients. Their purpose is to acquire the best quality of health care, regardless of cost. Purpose as an end was discussed earlier. The measure of performance for patients is a satisfactory outcome of treatment. When a need is fulfilled, the illness will have been cured or contained, but the measure in terms of wants is linked to the satisfaction of expectations. Due to the difficulties inherent in the transfer of images discussed in chapter 1, the satisfaction of expectations is sometimes difficult for physicians to ascertain and dissatisfaction, because of a mismatch of ideas, can easily lead to disillusionment and legal difficulties. This is in contrast to need satisfaction, where legal difficulties will be the result of omission or negligence.

- Physicians. Their purpose is to provide health care to patients, in other words make their knowledge and skills available to them, and to earn the maximum possible income in return. Their measure of performance is professional status and income. Their need satisfaction was discussed earlier. There still are some physicians who feel called in the historical sense to serve their communities and whose measure of performance is personal satisfaction. The idea that the practice of medicine is still a calling (see chapter 3) is often used to manipulate physicians. For example, business concerns and governments employ physicians, who are not allowed by them to negotiate their salaries and working conditions in a similar fashion to other health care employees. Their presumed ethical responsibility towards their patients is used as a powerful tool against

them. In most countries physicians are prohibited by law from engaging in industrial action. No other profession is singled out in the same way, which in a sense is society's way of confirming the professional status of physicians. This is interplay is part of the tension between business and professional ethics identified in chapter 3.

- Administrators. The purpose of administrators is to spend less on health care than they receive in premiums, and their measure of performance is a balanced income and expenditure statement, and a sufficient profit to ensure personal remuneration. In modern health care systems, administrators are often employees in for-profit organisations. The measure of performance then becomes a sufficient profit for distribution as a dividend to shareholders. This creates a value dilemma: Is it acceptable for excess funds, or funds generated by savings in the health care system, to be distributed outside the system? In a free market model, the argument is that such funds are reinvested in new health care ventures, but there does not appear to be convincing proof for this. Furthermore, who determines optimum reinvestment in a socially responsible way?

- Health care systems (hospitals and pharmacists). Their purpose is to make facilities available to physicians for treating patients, and their measure of performance is maximum profit. In the case of government institutions the aim is not profit, but at the present time cost containment.

- Other clients are parts of the larger health care system and the social system in general. For example, patient employers who contribute towards health care insurance and whose purpose is to pay the lowest premium to medical administrators that will retain satisfied employees. These clients are not within the boundary selected for this study.

3.1.1 The client in a social system patient-physician interaction

Who would the clients be when the world view of health care is altered to a systems model of health care and what would their ideal purpose and measure of performance be?

- Patients. The purpose of patients in a systems model of health care is to remain in the asymptomatic or symptomatic well group of the community (groups A, B or C), and the measure of performance is their ability to fulfil this purpose within the community as efficiently as possible. This may result in a community that benefit from the ability of its members to live their lives to their full capabilities (in other words satisfy Blum's definition of health care (see chapter 4: page 43). Such a state of affairs could lead to the betterment of society as a whole, where everybody benefit from the fitness of its members.

- Physicians. The purpose of physicians in terms of this model is to move patients from the hospitalised and symptomatic groups (groups D and E) back into the community, and the measure of performance then ought to be a minimum number of patients in the health care system, in other words the opposite of the present system. The problem with such a change in world view is the fear of a loss of income. It is possible to allay this fear with a remuneration system that rewards the purpose of physicians in a systems model of health care, rather than for time as at present, as will be shown.

In terms of Ulrich's modification of Churchman's methodology, patients and physicians are affected by decision making and therefore ought to benefit from planning. By involving them in planning, they may be enabled to learn about the results of their actions upon the system, and this may ensure that their ideals and values are incorporated in the design (the source of motivation). Neither of these two groups have the resources to implement their planning,

which is why they are clients and planners who ought to benefit from the system, but not decision makers in a strict sense. It ought to be possible for patients and physicians to participate in the planning of their own futures, which may lead to improved implementation and a more efficient system (lower cost).

In the traditional model, there is a needs-wants dilemma as described. This dilemma needs to be resolved at the level of the patient as client, in other words at community level, since in effect it involves the purpose of the community. The purposes of the community and patients need to be integrated in terms of a social system model, since it has a direct effect on the patient-physician interaction. At present there is a tension between personal wants and communal needs.

If a new expensive treatment is discovered, the wealthy are allowed to buy it regardless of whether the treatment is efficient or not. Patients with a lower income then demand the same treatment, which is eventually provided at a cost. The problem is that when resources are limited the treatment cannot be given to everyone and the question then becomes: Should it be denied to everybody including those who can afford it? (Donaldson, 1992) There is a tension between what is good for the patient and what is good for society (Fuchs, 1984). Furthermore, inequality is a consequence of the distribution of social advantages and inequality in health care is a reflection of this reality. Hence, the redistribution of resources denies people with a social advantage the ability to achieve health[57]. On the other hand, it would appear as if education, skills, and an expanding economy, are more important for achieving the maximum health for the largest number of people. It is with the implementation of the latter that government has an important to role to play in terms of a systems model of health care.

The problem can be approached in a different way, by asking: Who is the source of expertise that can resolve the needs-wants dilemma? It has been proposed in this study that needs are about illness and the experts about illness by definition are physicians. Therefore physicians may be used as the planners for patient needs. On the other hand, their are no experts of wants and the source of expertise are the patients themselves. In terms of the argument, individual wants lead to the exhaustion of funding, the common resource. Therefore, the solution of the wants dilemma is the resolution of the individual versus communal wants tension referred to earlier in this chapter. This may be facilitated through the application of a systems model of health care.

The situation where all the members of a community can have unrestricted access to all the possible treatments for illness is an ideal (De Wet, 1991:14)[58] that cannot be achieved at present, but it can be approached infinitely. Planning therefore has to address what can be achieved within the resources available at present.

3.2 PLANNERS (The source of expertise)

The discussion in chapter 2 has shown that the following groups and institutions presently participate in health planning:

- Governments. Governments as planners have no expertise to contribute towards planning. Traditionally they assemble boards of inquiry whose purpose is to provide plans to solve their problems. The dilemma is, how do governments select the expertise for boards, and how do they guarantee that such members are in fact the best experts available? Often,

[57] The amount of health that social advantage can buy is a matter of debate.
[58] This is the often quoted ideal of an equitable distribution of health care. The achievement of this is an ideal that cannot be attained within the present socio-economic reality (De Wet, 1991:14).

the selection will show a political bias in order to satisfy predetermined political positions. Plans are therefore formulated that will satisfy the aims of ruling parties, in other words it is an example of goals planning, the ultimate aim of which is to secure re-election. The controversial Deeble plan for health care in South Africa is a striking example of such planning. Other constraints to planning often are specified time limits, lack of funding, specified parameters that limit the scope of inquiry, and difficulties in assimilating the views of all those involved by the results of planning. In other words, this approach suffers from the deficiencies of goals planning, of which the most serious is a lack of attention to values and ethics, and specified limitations that inhibit the scope of inquiry. Therefore, such plans cannot guarantee that society will benefit from their introduction. The metaphor is mechanismic.

- Business. The approach of business to health care planning is that of ways to control and manage the system. The assumption is that the system cannot manage itself and business can offer the necessary expertise to do this for them. It also assumes that management principles that apply to business can be applied to health care. Planning therefore consists of finding ways to adapt these principles for use in the health care system. The approach is that of goals planning and therefore, again, there cannot be a guarantee that such an approach will be beneficial to the health care system and society in general. The operative metaphor is organismic as shown in chapter 2.

- Social scientists. They plan for health care in academic and other institutions. They have an important contribution to make to the process of planning. However, their paradigm at present is a scientific one based upon a linear causality model, which restricts their ability to address the complexity of the health care system. The restricted model seriously limit their ability to guarantee betterment of the system through their planning.

- Medical associations. These organisations represent physicians, their aspirations, and values. As such they potentially have an important role to play in planning, which is not the case at present. They have the power to alter the world view of their membership and therefore potentially the whole health care system. Unfortunately, the purpose of their present planning is to protect the status quo in health care.

- Systems planners. Systems planning requires the participation in planning of all the stakeholders in the system (patients, physicians, administrators, government, etc.). Participation in planning and inquiry may lead to aligned self-control and a changed world view. The purpose is ideals planning and includes the aspirations and values of all stakeholders, in other words, the aim is to align their purposes. Since planning is never complete, the process is a never ending cycle of planning and learning. Furthermore, in a rapidly changing environment plans are often obsolete by the time that they are implemented and therefore have to be continuously adjusted. A shared vision of health care is the best guarantee that the members of the system will agree to implement potentially beneficial changes. The planner in this model, is whoever can assist the members of the system to plan for themselves.

The biggest problem of planning is that of implementation. It is the proposition of this paper that the notion that patients may respond well to participation is feasible, particularly if the idea can be introduced on a smaller scale, in other words at the patient-physician interface. Participation can be ensured through consumer groups and the teaching of self-care.

3.2.1 Participation

A. Patients

The idea that the community ought to partake in health care systems has been championed by planners of primary health care systems (Shisana and Versfeld, 1993). The problem with their approach is the implicitly stated position that the community should participate in the management of health care, rather than planning. According to Shisana and Versfeld (Shisana and Versfeld, 1993), there are at least three levels of community participation, namely:

i. A contribution towards predetermined plans (the implementation of goals planning).
ii. Representation in organisational structures (power sharing).
iii. The empowerment of the community to make decisions about their own affairs (self-reliance). This in principle is the position closest to a systems approach, although in this context the implied aim is management rather than planning.

Community participation in terms of Shisana and Versfeld's paper is meant to be at the level of primary care and prevention, in other words groups A to C in a systems model of health care. It is based upon the deprivation model of illness. The result is that community participation has not yet been shown to be of benefit to communities. In this instance, the community participates without the benefit of a clear world view of illness and health care systems. Shisana and Versfeld's paper also suggests that elected politicians can be substituted as representatives for the community, and can therefore act as planners for the community. This is an erroneous belief since they are elected on the basis of a political system of which the predominant metaphor is power.

In a systems model of health care it does become possible for patients to participate in the system. It becomes the responsibility of family practitioners to involve patients in a learning system in terms of their altered responsibility in this model. They are in a position to teach skills of self-medication, preventative medicine, etc., to patients during the patient-physician interaction. Knowledge can also be transferred to the community through the use of consumer groups, a concept that has been used effectively, for example by the Springs Independent Practitioners Association (SIPA)(Nienaber, 1995). Consumers were divided into groups that were informed about the effect of their actions, both communally and individually, on the local health care system. In this example, the approach lead to significant savings and learning. A study has indicated that educational material about the proper role of self-care included with patient accounts, can reduce ambulatory care by 17% (Milstein et al. 1989)[59]. Consumer groups could also become a vessel for effective feedback from the community to the system and therefore may solve the problem of participation of the community in the planning process indirectly. In this way, knowledge is transferred and at the same time the community may learn how their actions contribute to problems in the health care system. The transfer of knowledge therefore contributes towards a learning system for all the members of the patient-physician interaction.

B. Physicians

It is important to ensure the participation of physicians, who "control" much of the patient-physician interaction[60]. Two areas will need to be addressed to ensure their co-operation.

[59] In traditional communities, self-care was taught to the young by the older members of the community. The view that physicians should take over this role (which drives up cost) may be the result of a loss of traditional systems in the community.

[60] Decisions made by physicians lead to 70 to 80% of health care costs (De Wet, 1991:10).

i. Agreement on treatment protocols.
ii. Remuneration.

The effect of feedback about practice profiles in controlling physician behaviour has been shown earlier. Furthermore: "*Local activities have the advantage of placing control of the change of process in the hands of the affected physicians, removing the perception that the guidelines are outside directives*" (Lomas et al. 1991:2202). This group showed that physician behaviour is significantly changed by the use of local opinion leaders with educational support, as compared to audit and feedback, or no intervention at all[61]. The success of the intervention may be because the community select their own regional opinion leaders who can take local circumstances and cultures into account to guide educational activities[62]. Personalisation is therefore an essential component for effectiveness and is an acceptable systemic position.

The problem of remuneration will discussed in the next section.

In summary, participation is based upon a vision of health care delivery that in turn is based upon a comprehensive or systems approach. The challenge will be to convert physicians and patients to buy into this vision. The vision is not about changing the health care system, but about seeing it in a different way. The model avoids the problems that attempts to control physicians and patients directly have. The basis is ideals planning and the time to effect therefore is long as to be expected. However, by altering behaviour, the long-term gain may be better than short-term discomfort.

3.3 THE DECISION MAKER (The source of control)

Decision makers have the means or resources that may enable the implementation of the systems model of health care. In the traditional system the following decision makers can be identified:

- Governments. They control the resources of health care (physicians, education, pharmaceutical industry, hospitals, etc.) through regulation. The political system has the power to make laws pertaining to the health care system and have the resources (civil service, legal system, tax system, etc.) with which to implement them. In terms of the health care system, they therefore have the means to change its future. However, they cannot control the complex interactions that constitute social interaction, illness, the patient-physician interaction, etc., in other words, the total environment of the system.

- Business. They control the important resources that make health care delivery possible (manufacturing of health care products including pharmaceuticals, hospitals, nursing staff, medical insurance, etc.). These resources are often used to control physicians and patients through the manipulation of funds, and the control of inputs and outputs. The co-producers in the environment that are beyond their control are the same as for governments.

[61] Audit and feedback were not significantly better than no intervention at all.
[62] Of interest is that in 25% of cases, patients insisted on not following the recommended protocol. In 25% of cases in the OLE group, physicians did not offer the protocol, which may represent physician bias. One can conclude that decision making was influenced in 25% by patient wants, 25% by physician wants, and in the remainder by accepted clinical practice.

- Medical community. They control the knowledge and skills that makes the treatment of illnesses possible. Factors in the environment beyond their control are government and business.

- In terms of the ideal health care dispensation, patients ought to be decision makers as well. They are in control of many of their illnesses (smoking, bungee jumping, industrial accidents, etc.), and therefore have the ability to select their own objectives and means for pursuing an improvement in their health. Their selection of physicians have an influence not only on the satisfaction of their objectives, but also have an influence on the problem of cost. Their image of health care ought to be altered to include patients as decision takers as regards those aspects of illness that they have the ability to change.

It was shown earlier that patients and physicians find themselves in a position where they are unable to personally address the ills of the health care system, although according to the thesis of a malfunctioning patient-physician interaction, they are largely responsible for the failure of the system. The reason is the fact that they do not control any of the resources that may help them to change the current paradigm. Who does control these resources and can therefore implement the results of health planning? The two most powerful of these actors are government and the business community (administrators) and if the aim of planning is to make changes at the patient-physician system level, the latter has an important role to play.

3.3.1 Governments

Those systems that appear to have withstood the difficulties of the health care system best are the mixed-model social insurance type of systems. The implication is that some sort of regulation to control the system may be beneficial. Therefore, this kind of option represents the synthesis between the opposites of a free-market system and national health. It represents a dialectical synthesis.

The problem of course is to ensure that government policies are not contradictory to health care policies. For example, in the USA government subsidises the tobacco industry and yet, this industry plays a large role in increasing health care costs through causing ill health. The Rembrandt group in South Africa is active in both the tobacco and health care industries, which is an anomaly. Governments therefore have to take a broad view in their decision making to avoid this sort of difficulty (Teisberg and Porter, 1994).

Furthermore, they have the power to alter not only barriers to entry into the medical profession, but also the education of physicians. Therefore they are in a position not only to implement a systems model of health care, but also to alter the world view of illness and health.

3.3.2 Business

The organised structures with the best opportunity for changing the patient-physician system into a social systems model is the business community. They are in command of the resources (funds, manpower, infrastructure, etc.) that can be used to alter this system into a learning system. Their purpose would be to assist in a venture that could have a profound influence on the health care system in general, and with the potential for large cost savings. Ultimately, they would benefit from the interaction. Furthermore, such intervention does not require a large investment of money, but rather an investment in time and a belief in the vision that has been described in this chapter.

The aim of intervention would be a system that functions more efficiently, in other words more purposefully.

3.3.3 Efficiency

Efficient: a) *productive with minimum waste or effort*; b) *capable* (Allen, 1992)).

To be efficient, the patient-physician interaction will have to:

- Use resources more efficiently.
  a) Have communication of a high order
  b) Use experience and knowledge in the system effectively.
- Work within a revised model for comprehensive health care, such as the systems model.

A physician network system could satisfy these criteria, in other words a re-structuring of resources could ensure a better functioning whole at a lower cost and of higher quality (Rutstein et al. 1976). It has been described earlier how such a system could improve communication between physicians, and how it may increase the use of available knowledge.

In a network, control of the physician system is no longer the function of a gatekeeper, but becomes the responsibility of the network as a result of aligned self-control. For example, at present radiologists perform many expensive diagnostic procedures that they believe are unnecessary for proper diagnoses. However, if they refuse to do so they will be punished by the remuneration system. If the structure of the system is altered to avoid this problem, the diagnostic disciplines can become gatekeepers in their own right. Similarly, in teaching hospitals the highest hurdle to clear to book a case for surgery is the anaesthetic department. Again, in the FFS system anaesthesiologists cannot afford to fulfil this function. However, in a network system, this discipline could act as a gatekeeper against unnecessary surgery. This raises another cornerstone of a physician network system, namely remuneration.

3.3.4 Remuneration

The current remuneration system rewards time (Coopers, du Toit, 1991; Coopers, du Toit, 1992) and not the knowledge and skill that physicians make available, in other words it does not reward those actions that constitute the purpose of physicians. As discussed in chapter 2, it is agreed that this kind of reward system leads to perverse incentives and abuse and therefore has to be changed. It is difficult to determine the optimal remuneration method, and a system with multiple options may be the most efficient one. It is accepted that a system with potential rewards and risks has a definite influence in encouraging better practice (Milstein et al. 1989). On the other hand, financial penalties have a negligible influence on effective practice. Options that have been shown to lead to efficient use of medical resources are salary and capitation systems, with or without bonus rewards. The social model of health care in Germany uses a salary system for physicians who are accredited to give hospital treatment and a capitation system for physicians who may consult only, and this model has proved to be effective in containing cost (see chapter 2).

Another alternative would be to reward knowledge and skill. Such a system would remunerate for diagnosis (knowledge) and procedures performed (skill) only. The diagnostic fee would be for making a correct diagnosis and would include the use of additional diagnostic tools to do so, such as endoscopy, EEG, urine tests, lung function tests, etc. At present there is an additional reward for using these tests, which in many cases lead to abuse. Such a system could lead to a large reduction in the use of unnecessary tests, which often is

hospital based, and this can therefore lead to a large reduction in cost, but not at the expense of physicians. Autonomy in decision making is not affected either, since the aim is accurate decision making.

Procedures (skills) may be rewarded according to three scales to reflect the difficulty of procedures, for example minor, intermediate, and large or complicated. The fee would be for successful treatment and therefore includes visits relating to the operative treatment. It also means that physicians would have to accept the risk for complications and its treatment, for which there would be no additional reimbursement. The risk for unnecessary procedures may be monitored through mandatory second opinions for elective procedures, which in effect is a form of indirect peer review. This ought to be a strong motivator for efficient practice.

The emphasis in a system that rewards knowledge and skills is on quality and efficiency, in other words the system creates an incentive for physicians to use their knowledge and skills more efficiently for the purpose of returning patients to self care. Such a system is appropriate to a systems model of health care.

Finally, the only two structures who control the resources to alter the system of remuneration are governments and business. They are in the position to redesign the remuneration system, which as part of a comprehensive redesign of the patient-physician system may contribute towards a more efficient system.

3.4 SYSTEMS PHILOSOPHY (The source of legitimation)

The final question, according to Churchman, is whether the systems approach has been successfully used for planning improvement. This question has to include the views of the enemies (politics, religion, aesthetics, morality), and has to show the significance of the plan. Ulrich interprets this to mean the fact that someone should act as witness for the affected who are not part of the planning, but who have to live the consequences of the plan. The question of meaning and witnessing have to be addressed. It is in this area that the organised medical community could have a large and as yet unaddressed role to play.

The different medical associations have neither statutory rights, nor do they function as labour unions. They consequently have neither power over their members, nor real power for negotiation with other parties. It is the thesis of this study that the role of these organisations ought to be redefined. At present their role is unclear and mostly appear to be related to tariff negotiations and education. They tend to react to changes in the environment rather than anticipate and influence them.

However, they are in the unique position that they could play a leading role in redefining the world view of illness and health (Levinsky, 1984b) particularly amongst its members (physicians). In this way they have the opportunity serve as the conscience of their community. But more importantly, by sharing a world view of illness and health care, they may play the vital role of being the ethical conscience of the profession, whilst acting as the conscience or witness for patients at the same time, in other words for the people who are affected by planning. This satisfies the dilemma of serving the common good of both the patient and the community (De Wet, 1991:30). In terms of Churchman's concept of ethics, both the community and physicians will benefit from such an interaction, enabling both to live out their individual wishes. Such a state of harmony is very similar to that of the primitive health care system (see chapter 3).

Medical ethics can be defined as: *The inquiry during which the concepts, assumptions, beliefs, attitudes, reasons, and arguments underlying medical-moral decision making are*

examined critically (Gillon, 1985:1117). Accordingly, medico-moral decisions concern the values according to which it is decided whether something is right or wrong, and ought or ought not be done. The ideal of a comprehensive moral theory for medical practice based upon universal principles applying to all, and capable of justifying conduct in individual cases, has not been attained. However, from a pragmatic point of view this ideal can be approached infinitely. It is in this that medical societies have a potential role for being a moral standard bearer.

One of the core issues in medical ethics is the way that physicians balance personal interests against the interests of the patient (Pellegrino, 1987). For example, do physicians have a duty to treat under all circumstances, and if not, when? (Gillon, 1985; Pellegrino, 1987). This is the intrusion of physician needs and wants (see chapter 4). There is a modern concept that medical practice (and the selling of knowledge and skills) is a business like any other business and the ethics of business therefore apply to it. The tension between business and the professions has been referred to in chapter 3. This position is untenable for three reasons:

i. Ill people are in a position of weakness and vulnerability (expose themselves to be examined and allow themselves to be touched by strangers) and can therefore be exploited. They have to trust the physician during their predicament, something that physicians invite when they put their knowledge and skills to the disposal of the ill.
ii. The knowledge that physician acquire (through their education) is through the sanction of society.
iii. This creates a moral responsibility towards society, which is acknowledged by the oath at graduation (see chapter 3)(Pellegrino, 1987). This professing to be a professional is an ethical act (Kass, 1983), during which the physician undertakes not to take advantage of the patient's position of vulnerability.

The ethical position is under continuous attack from the legal profession, government, consumer groups, and others (Kass, 1983; De Wet, 1991:5). The problem is that these groups themselves contribute to the ethical position (value system) of society as a whole. Ethical decisions are therefore no longer an individual choice, but in many cases ought to be a consensual decision between a number of interested parties. The medical profession as the interface between symptomatic illness and society may have a role as the facilitator in this process. The role becomes critical in providing an ethical foundation for health care policy decision making. They therefore act as the conscience for the value implications of decision making (see chapter 5). In this way they may therefore act as witness for the community.

Finally, the position of the enemies has to be considered. It has been possible to include the views and concerns of government, business, the social sciences, etc., as part of a comprehensive plan or solution to the health care dilemma in the suggested systems model of health care. This plan is the synthesis of the positions of the enemies on the one hand and systems philosophy on the other.

The introduction of managed care options, in effect, is a system for rationing health care (Samuelson, 1993). Governmental options have the same effect. In Britain's NHS system rationing effectively already exists (Schwartz and Aaron, 1984). This is done by limiting resources, which in turn leads to waiting lists[63]. The environment responds by growth in the private sector to accommodate those cases that can afford to pay and do not wish to wait. The biggest problem is, who decides which patients get what treatment and who tells them? In the

[63] In 1979, 31% of the 556 000 patients awaiting surgery of all kinds had been waiting for more than a year (Schwartz and Aaron, 1984). Of urgent cases, which represent 7% of waiting cases, 75% had been waiting for more than a month.

NHS system this responsibility is delegated to physicians, which creates tension between the ethical position of physicians and the reality within which they have to live. Physicians then do not tell patients if a certain treatment is available, which can be the source of friction if the patient discovers the deceit. In Britain, this tension is balanced by the difficulty of litigation which is the result of the British legal system.

In terms of an ideal of comprehensive health care, rationing in some way for the moment is a reality, but in the long-term may fall away. The reason that rationing and control are instituted is the failure to confront business and government with a better more comprehensive plan. The systems community so far have failed to present a convincing alternative. The suggested framework could form the basis for such an alternative, but the co-operation of business and government will be vital for implementation, in other words to assist in changing the minds of the community.

4. A Churchman approach to the diagnosis-treatment system

In chapter 4, the need for a method of inquiry that will improve the application of medical knowledge was identified. Churchman's philosophy and methodology has another important potential application, namely in the diagnostic system. If the purpose of the physician is to secure an improvement of the patient's condition, then the physician could be seen as a manager of illness. According to Churchman, a manager is someone who decides among alternative choices (Churchman, 1968:17). Physicians state a differential diagnosis (alternative diagnoses) before selecting the most promising alternative as the final diagnosis. They also choose between alternative treatments for the condition that they have diagnosed. Whether physicians are good managers is a matter of opinion, and finding suitable criteria for identifying the best managers is problematic[64] . The critical point is efficiency in the decision making process.

If this approach is applied to the patient-physician interaction (refer to diagram 11, page 71), the following discussion has relevance.

The environment from which patients and physicians get together to interact, may be altered through the use of a systems model of health care. Patients benefit from the interaction through their improved health, whereas physicians benefit from the experience that they gain (learning), as well as the remuneration for their services. Both are therefore clients of the system.

During the diagnostic cycle the questions: What do I know, and how do I know that I know?, have to be asked repeatedly. The patient's history may have a large subjective component as described in chapter 4. The problem is that the physician has to rely on the patient's word that the experience is described correctly. The subjectivity is tested during the rest of the diagnostic cycle. During the physical examination additional information is collected to verify the history. In a way, the interaction can be seen as a laboratory in which the patient is observed. The problem is, how objective are physicians when they make their observations, and how can they be certain that what they observe is correct? Furthermore, these observations lead to conclusions based upon inductive reasoning and if the observation is incorrect, so are the conclusions. Therefore, to form a better understanding of the information collected during history taking and the physical examination, the additional knowledge that the physician has from learning and experience is swept into the inquiry.

[64] See *The myth of management* (Churchman, 1968:17) for a discussion of this problem.

This knowledge is mostly the result of academic learning. The problem then becomes: How much knowledge about the condition under study does a physician have, and how was this knowledge acquired and validated? The answer to this dilemma may be found by the use of Churchman's inquiring system. Medical knowledge is constructed in fact nets, of which the contingent truths are usually determined empirically and validated by a community of inquirers (experts). The difficulties associated with this was discussed in chapters 4 and 5. It becomes important for physicians to ask what assumptions they make about these facts and furthermore to consider the dialectic alternatives. In other words, what alternatives (differential diagnosis) are there to the most likely diagnosis (hypothesis). A pragmatic approach requires that a diagnosis (decision) be made, but the physician has to realise that the decision is based upon incomplete knowledge about the condition. Therefore, the outcome when the hypothesis is tested (by treatment) has to be observed and the hypothesis adjusted until the goal of a cure or improvement is attained. In this way, continuous learning by experience may take place. Furthermore, to approach the ideal of complete knowledge about the condition, a program of continuous post-graduate education is a necessity in order to improve decision making ability. This approach confirms the finding in chapter 4 that diagnoses ought to be made by a cycle of inquiry.

If the findings cannot be explained, in other words a final diagnosis cannot be made, more information must be swept in. Information may be acquired by additional study, consultation with a colleague, or special investigations. Inquiry can also be broadened to include information about the environment of patients, in other words how their family situation, work situation, etc., contributed to the problem. Family practitioners have a particularly important role to play in this regard in terms of a systems model of health care.

The diagnosis may be tested by the use of special investigations. In a rigorous system of inquiry, testing may be done more purposefully and therefore more efficiently in the pragmatic sense. Testing becomes a measurement to prove a hypothesis, rather than a random search for a solution. The difficulties associated with testing was discussed in chapter 4 and that with measurement in chapter 5. Most medical tests are based upon the statistical probability that a certain measure will be normal if it is found to be within a certain range. Asking the right question is therefore important for arriving at the correct conclusion.

The decision to treat has two components, a dialectic, and a value question. The dialectic is in terms of the appropriateness of treatment. What alternatives are available, and which one or combination is most appropriate to the particular case? What guarantee is there that whatever option is selected will improve the patient's condition (ensure betterment)? The value question is: What is in the patient's best interest? It also questions the motives of the physician in making a particular decision. Lastly, the enemy of the treatment has to be considered. Is it possible that the patient's expectation, however irrational it may be is the best solution to the problem? In terms of a learning cycle, reflection upon the outcome of treatment is a vital component of the process of inquiry. Through reflection, more perspectives can be swept in that in turn may lead to better understanding and learning.

The quality of the outcome of treatment is determined by:

- The quality of the decision that determines what actions is taken (knowledge).
- The quality with which those actions are executed (Eddy, 1990a) (skill).

According to Eddy (Eddy, 1990a), the goal of the treatment decision ought to be to choose the outcome most likely to deliver the outcome that the patient finds desirable[65], in other words to satisfy the measure of performance of the client. To make this decision two steps are needed:

i. The outcomes of alternative options must be estimated. (Are the treatments feasible?)
ii. The desirability of the alternative options must be estimated. (Are the treatments desirable?)
    a) The benefit of the option must be compared to the potential harm (risks, side-effects, inconvenience, etc.) to the patient.
    b) Outcomes must be compared with the cost of the options. Can the health care system afford the treatment?
    c) If resources are limited, priority must be given to options likely to have the highest yield in terms of outcome.

The treatment decision is therefore a question of values and preferences. Patients have to live (or die) with the outcomes and therefore are the sole experts of what the appropriate treatment is for them. The fact is, that in medicine there is no single correct answer due to the complexity and incompleteness of knowledge. The role of physicians as planners, or experts, is to supply patients (clients) with the best possible information to arrive at a decision. Physicians contribute the empirical component, but patients add the value component to the treatment decision. In an ideals based system, decision making therefore ought to be the product of the interaction between patient and physician. In effect, physicians attempt to present possible scenarios of outcomes based upon the inquiry into the illness, which may assist patients to select the most appropriate option for them.

Errors occur in decision making (see table 3) if:

- there is a misperception of the outcome; or
- there is a misperception of the patient's values.

Table 3 : Outcomes

Misperceptions of outcomes occur when:	**Misperceptions of preferences occur when:**
• Important outcomes are ignored. • Extraneous outcomes are included. • Available evidence of an outcome may be incomplete. • Existing evidence may be overlooked. • Evidence may be misinterpreted. • Personal experience may be too heavily weighted. • Wishful thinking.	• Patients misunderstand an outcome • The measure of outcome is misleading. • The outcome is presented in ways that lead to different conclusions. • The patient is not consulted at all (the usual situation). • The physicians project their own preferences on the patient.

Outcomes that are important to patients are pain, anxiety, death, disfigurement, and disability. The participation of the patient in decision making is important, for if patients elect to delegate the decision to the planner, the latter assumes the responsibility for projecting not their own, but the patient's values instead onto the process. This can only be possible within

[65] Eddy's work is based upon the traditional health care and illness models. Here however, the model will be used in terms of a systems model of health care.

a model with a strong ethical base and a desire to improve the patient's condition in a responsible way. Churchman's approach can make a significant contribution in this regard.

4.1 SUMMARY

- Both patients and physicians are clients of the diagnostic system. Their purpose and measure of performance is determined by the operative model of health care.

- Physicians are expert planners who are contracted to achieve the goal of a healthy patient. It is a well-known fact that the majority of patients do not complete prescribed courses of medication, and that only a small number take their prescriptions as prescribed. This is partially the result of the fact that patients have no understanding of illness processes and the effect that their actions have on it. Better implementation of treatment may be achieved if patients participate in the planning of their treatment. The result of this not only may be the only guarantee for a better outcome in a process where neither physician nor patient has complete control, but may also assist in a process of learning.

- Physicians as expert planners have no moral authority as far as the condition of patients is concerned. Therefore, patients have to be able to participate in the planning of their treatments to enable them to include their wishes and values in the decision. For example, it may include their religious beliefs (being a Jehovah's Witness they may refuse blood transfusion), their culture (referred to in chapter 4), etc. It has been described earlier how such participative decision making in medical diagnosis has a beneficial effect on the outcome of treatment. Physicians and patients therefore both ought to be decision makers.

- The means for implementing treatment, knowledge and skills, are controlled by physicians directly, and additional resources required for treatment (hospital, medication, diagnostic equipment, etc.) indirectly. They do not control the health care environment described earlier (government regulations, business, etc.) that may influence their ability to use the resources potentially available to them. The effect of the environment on their decision making was described in chapter 4.

- Physicians, as experts, have to be aware of the poverty of their knowledge. They ought to constantly reflect on what they know and how they know that to be true. Churchman's methodology is a powerful tool for achieving this goal. Furthermore, it ought to be their constant purpose to increase their knowledge through learning by self-reflection, communication with their colleagues, and continuous education.

- As the manager of illness, physicians ought to act ethically. There is nothing new to this, since the oath administered to newly qualified physicians has this as its aim. The ethical responsibility of physicians has been discussed earlier.

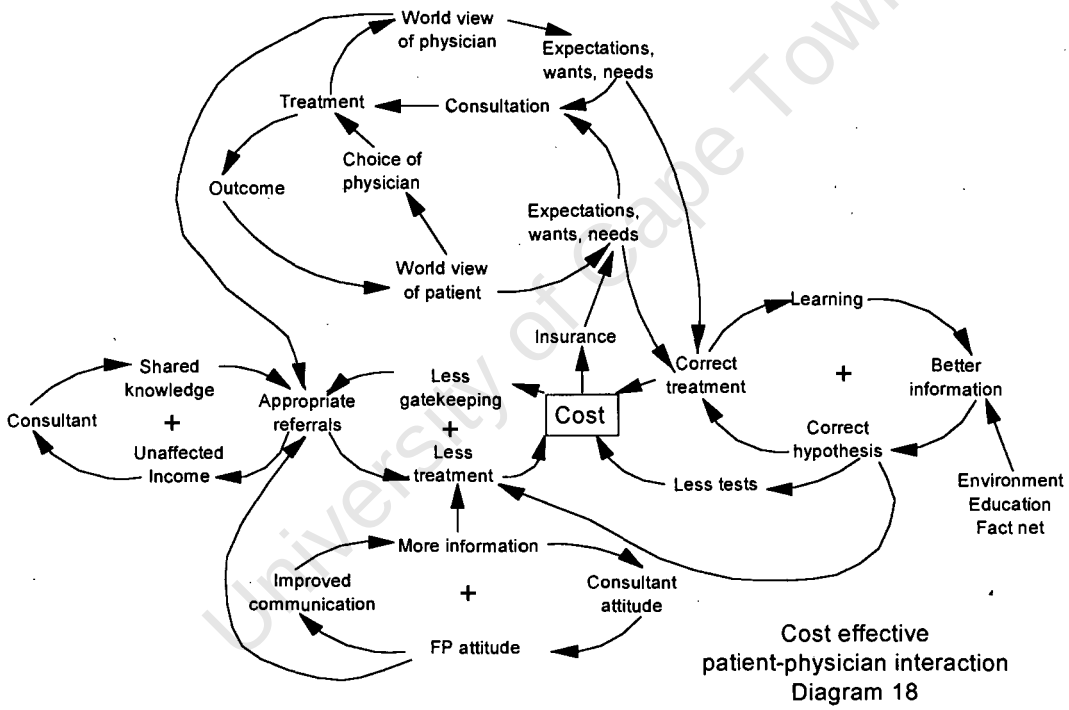
- Finally, physicians have to reflect on the inability of their craft to solve in a logical way many of the problems presented to it. Their inability to do so is the reason that their "enemies", the alternative approaches, are sought out by many patients. Furthermore, it is the reason that the moral, political, and religious enemies, are attempting to control the patient-physician interaction. Their views are valid, since physicians have not shown that they can ensure improvement by acting responsibly through the use of a different approach to diagnosis and treatment.

Alternative medicine has a distinct following, because of the inability of modern physicians to listen to the problems of their patients, and because of the failure of their science to "cure" in the way that patients expect. The failure is perceived within a linear causality model of illness that assumes complete control. This dilemma has been discussed earlier.

This section has shown that the application of Churchman's approach to inquiry and his methodology to the diagnostic system could significantly increase the rigour of this system, and therefore the quality of decision making. This could lead to better quality treatment and reduced cost. Modern medical professionals are not equipped with such a system of inquiry and the ideal would be to introduce such a system as part of their training. It could also be taught to physicians employed by government and managed care organisations.

5. Synthesis

How could the application of a systems model of health care approach affect the patient-physician system? (Diagram 18)



Cost effective patient-physician interaction
Diagram 18

This diagram should be read in comparison to diagram 11 (page 70).

1. An altered world view may assist patients in learning how their wants and expectations affect the health care system and therefore cost. They will learn that their actions will lead to increased insurance contributions, and that this can be avoided if they alter their behaviour and image of health care. This may prove to be the most powerful intervention for improving the system.

    - An altered world view may lead to the selection of physicians that have the ability to return patients to self care in a more efficient manner This would lead to improved treatment, better outcomes and reduced cost. Furthermore, better outcomes will reinforce the new world view. This could become a reinforcing loop and could also

create an indirect incentive for physicians to improve their knowledge and skills, in order to contract more patients.

- A systems world view of health care could lead to altered wants and expectations. These have been shown to affect the consultation system (see chapter 4). An altered world view may lead to an improved consultation process, better treatment, better outcomes, etc.
- A systems world view may lead to the expectation of correct and better treatments. Improved treatment will lead to reduced cost, less medical insurance, and therefore a reinforcement of the world view.

2. Physicians may learn how their actions affect the system, and that they may reduce cost by sharing responsibility, but not at their own expense.

    - An altered view of their role as professionals could lead to altered expectations, wants, and needs. These have been identified in chapter 4 as affecting the consultation system, hence an improved consultation system may lead to improved treatment and outcomes, and therefore a reinforcement of the world view. This could become a reinforcing loop that interacts synergistically with that of the patient world view.
    - The altered world view may increase the number of appropriate referrals and therefore have a positive effect on the physician network. This could stabilise remuneration, allay uncertainties, and therefore reinforce the world view.
    - A systems world view creates expectations of correct and better treatment, leading to reduced cost.

3. The effect of a physician network created by a systems view of health care could be threefold. These loops are connected and reinforce each other.

    - Remuneration rewards the efficient use of knowledge and skill and therefore purpose. Family practitioners and consultants no longer compete for funding, since they are rewarded for different purposes. This could lead to increased sharing of knowledge and more appropriate referrals. Appropriate referrals ensure a sufficient income to consultants, who are more inclined to share knowledge and a reinforcing loop is created.
    - The improved attitude of consultants could lead to an improved attitude of family practitioners, better communication, and increased sharing of clinical information. This may reinforce the positive attitude of consultants. The sharing of clinical information also leads to less repetition in testing and prescribing, less treatment, more appropriate treatment, and less cost.
    - Family practitioners no longer feel threatened by consultants, leading to more purposeful communication and more appropriate (early) referrals. This may lead to better treatment and less cost.
    - Furthermore, more appropriate referrals and less treatment reduces the need for gatekeeping. This may lead to less resentment from consultants, more appropriate referrals, etc.

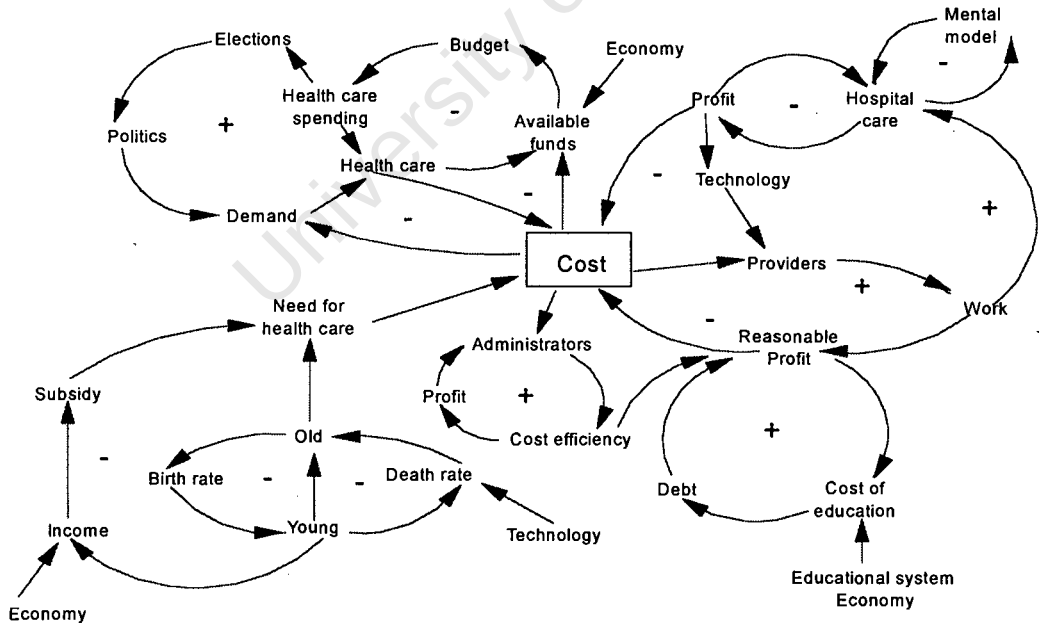
4. In a systems model of health care, patients and physicians would expect better, more purposeful treatment. This could improve the learning of correct methods of treatment, leading to better information and knowledge, better diagnoses, and better treatment. The latter in turn leads to reduced cost. Furthermore, better diagnoses could lead to fewer tests and therefore a further reduction in cost.

5. A reduction in cost is achieved in the patient-physician system through less and better treatment, and fewer tests. This could result in a reduced need for gatekeeping and a reduction in patient insurance.

A systems model of health care may also have the following effects.

- A multiple causality model of illness may lead to a better understanding of what can be achieved and how. Such a model may lead to the efficient use of information, an increased number of correct diagnoses, more correct treatment, and learning. The latter could feed back into more knowledge and this loop could become a positive reinforcement loop for knowledge. Furthermore, it could lead to more appropriate research that could also reinforce learning.
- An altered image of physicians may identify a different purpose for them in the health care system. They become members of a community of physicians, who in turn are part of the community as a whole. Therefore, physicians would not lose their status in society, but on the contrary, they may resume a more traditional role.
- The role of alternative medicine has been defined as contributory and not in opposition to traditional health care. This may lead to better interaction between traditional and alternative healers, since both are included in the health care system as a dialectic synthesis.
- The application of Churchman's philosophy to the diagnostic cycle, may have a profound influence on the quality of diagnosis and decision making. This may in turn improve the quality of treatment and reduce cost.

A systems model of health care may also have an effect on the health care system on a higher level, in other words as a whole. Referring to the multiple causality model of health care (diagram 3, page 25), the following may happen (diagram 19).



The effect of a systems model on the problematique of health care
Diagram 19

1. The systems model may have only a minor influence on the economical factors that determine the availability of health care funding, the factors that lead to an ageing

population, and the power structures in the system (governments and business interests). It may have a more definitive impact on:

- The administrator system as a profit making entity.
- The hospital system as a profit making entity.
- The education system, including both the medical curriculum and the cost of education to newly qualified physicians.
- The political system and their use of health care demand to ensure electability.
- The factors that disturb the ability of the young to cross subsidise the elderly.
- The legal system as a profit making entity.

2. An altered world view could alter the demand for health care. This could reduce the need for health care delivery with a lessened impact by the political loop. A decreased demand could lead to less work and less cost. This in turn could reduce the demand on the budget for health care funding.
3. The systems view of health care may question the desirability of attempts by science to discover ways for ensuring eternal life. This may alter the wants, needs, and expectations of the community, with more attention to the needs of the elderly, as opposed to wants and expectations. This may reduce the need for expensive technology and increase the application of appropriate treatment, which in turn may reduce the cost to the system and the need for a crippling subsidy by the young.
4. An altered remuneration system may reduce the incentive for abuse and exorbitant profits. Therefore there may be less inappropriate work in the system and decreased cost. In other words, physicians may reduce their demands on the system.

- The cost of health care education is a problem of the larger environment and will need to be attended to a such. It is often stated that physicians have an obligation towards the community, because their education was subsidised by the state through taxes. This argument does not take into consideration the fact that physicians, by virtue of their income, will in turn contribute towards society by the taxes they pay. Furthermore, members of other professions, such as law, engineering, etc., appear to be exempted from this argument.
- More responsible and better treatment may lead to reduced litigation and therefore reduced malpractice insurance. This may affect the legal system. The realisation that physicians are not in control of illness and health care processes (a traditional assumption) may also influence the findings of inquests into possible negligence.
- The tension between physicians and health care administrators will continue, unless the principles of a systems approach to health care could be expanded to this level. Administrators at present appear to be unwilling to explain to physicians how savings and profits in health care will benefit the system[66]. If physicians do not feel that they will benefit from a more efficient system, they will be unwilling to implement planning to improve the system. The question of whether it is ethical to make a profit from members of the community in distress, and if so, how much is appropriate or desirable, will need to be answered as part of an inquiry into the values of the system.

5. A systems approach to health care may reduce the demand for high-technology treatment as a result of a better understanding of the relative value of it. This could reduce the amount of inappropriate work.
6. The changed world view requires a shift away from hospital care. This will affect the profits of hospitals and eventually also the demand for high-technology treatments and

[66] Personal communication with managed care administrators.

research. The emphasis is on appropriate specialist care as described earlier, the purpose being to move patients back into the community as soon as possible.

In many of the systems participating in the health care system, a political metaphor is operative. Hence, it may prove in time that in spite of advantageous changes that patients and physicians may be prepared to make, gains could be lost as a result of the power plays in these systems. Therefore, the implementability of the systems model of health care will in the end depend upon its environment. However, this does not imply that no attempt should be made to improve the system at grass roots level.

In summary, this chapter has shown how the application of Churchman's system of inquiry and methodology may be used for solving the questions posed in earlier chapters. The approach has been used successfully for discovering and exploring an alternative world view of illness and health care. The advantage of this world view is that it takes a broad view of illness and health in society. The application of this view has implications for the purposeful components of the system. Ways to implement a systems view of health care was explored and it would appear as if changing the way that patients and physicians think and interact, may have a powerful influence on the efficiency of the health care system as a whole. This may contribute towards a more affordable system. In terms of Churchman's approach, the implementation of a new world view does not satisfy a short-term goal. It is aimed at achieving a long-term ideal and is therefore an evolving process and a process of learning.

The application of Churchman's thinking to the diagnostic process may increase the efficiency of decision making. It supports the more efficient use and application of knowledge to this process, and leads to increased learning. Physicians may learn by constant reflection about their knowledge and the outcomes of their decisions, and patients through their involvement in the decision making process.

The aim of this study was to explore the reasons why the health care system is not functioning properly. The systems approach in general and C West Churchman's general systems theory in particular, is a suitable method for answering the question: How can the problems of the health care system be resolved?

CHAPTER 7

SYNTHESIS

This paper is the result of a study that took place within a learning system. Such systems have been defined as systems that gain knowledge through inquiry and experience. This chapter will be a reflection on:

- The knowledge gained as a result of the study.
- The process of inquiry that was followed.
- The experience from the study.

1. Knowledge gained from the study

Kolb has shown (see chapter 1, page 14) that the process of learning; is part of experience, is based upon a feedback cycle, is purposeful, and takes place within the framework of the environment, and in this case a learning environment.

1.1 THE CYCLE OF LEARNING

The aim of the study was to follow a cycle of inquiry (see diagram 1, page 9). The study started with a problem: Patients and physicians find that the health care system and health care delivery is not functioning properly. The visible symptom is a burgeoning cost problem that is rapidly depleting a limited resource, namely health care funding. An inquiry into the causes of the problem showed that they are the result of a complex social system that is not functioning efficiently. The historical image of health care and illness as simple linear processes were identified as major contributing factors. The application of this world view to the patient-physician system leads to complex interactions that have a negative effect on decision making. Diagnosis (decision making) leads to treatment, in other words, initiate the complex interactions in the health care system and therefore eventually present as cost to the system. These findings lead to the hypothesis that a system of inquiry that can address the complexity of the system and its interactions may contribute to a modified world view of health care and illness. C West Churchman's systems approach to inquiry was identified as such an approach. This approach was tested by way of a systems model of health care. It would appear as if such a model could lead to an improvement in the health care system and therefore a saving in cost. Furthermore, this approach by definition is aimed at achieving long-term betterment through a process of learning through inquiry. Hence, the application of Churchman's general systems theory to medical process and decision making could solve the problem which lead to the study. The study therefore achieved its first aim, namely answering a question by way of a learning cycle.

1.2 KNOWLEDGE

According to Churchman, knowledge is a product of the process of inquiry. The following is a report of the major general insights gained from the inquiry in this study.

Complex systems are active in the area between stability and chaos. They are continuously adapting to a rapidly changing environment. Adaptation takes place as a process of experience and learning. Furthermore, these systems have numerous components that are linked through complex interactions. Such interactions can be better understood in terms of co-producers that produce products by interacting, rather than the more prevalent simplistic linear model of causality. When traced in a systems dynamics model of causality, insight can

be gained of the co-producers, the interactions, the complexity, and the processes that lead to the products under study. Examples of complex systems are weather systems, and more importantly, human (social) systems. This study focused on the health care system as an example of a complex social system.

When interactions are conceived in terms of linear causal interactions, it leads to a belief that individuals or groups are the cause of the results of such interactions. Therefore, if the interactions are ineffective, someone has to be responsible because their actions show a lack of control. The belief that individuals or groups can control complex (human) interactions has no meaning in a complex social system metaphor. Of more importance is the alignment of the beliefs of the individuals who participate in these interactions. Alignment may lead to more effective interactions that may be of benefit to systems as wholes. This statement has two important consequences, namely:

i. Self-alignment takes place as part of group learning; and
ii. Interactions need to be seen in terms of larger wholes.

Group learning takes place when shared images are made explicit. Learning takes place through inquiry and experience, therefore, shared images may be tested through a process of inquiry. The knowledge gained from inquiry may be tested in practice and the experience gained from this becomes the source for further inquiry. Therefore, inquiry is a never ending process of learning.

Inquiry can be intuitive or rational. Because humans are conscious, they have the ability to use reason to inquire and make better decisions. Traditional systems of inquiry attempt to gain knowledge and understanding by dividing problems into their smallest components. Much knowledge may be gained from such an approach, but it gives no insight into the purpose of the systems and its effectiveness in fulfilling this purpose. This, as stated above, is a requirement of group learning and self-alignment. Therefore, for an inquiry into complex systems in general and human systems in particular, a system of inquiry is required that has the ability to form a better understanding by taking a broad view. Such a system is the systems approach.

C West Churchman in many ways was one of the leading figures in the establishment of the systems approach. His general systems theory has influenced many of today's systems methodologies. However, it appears as if in spite of this, his work has gained less recognition in more recent years. It may be that the depth and scope of his work is not recognised because of the difficulty of obtaining his texts, which are mostly unavailable at present. This study is an attempt to return to the principles of Churchman's systems theory.

In terms of Churchman's criteria for a system of learning (chapter 5, page 86): What has the study discovered?

1.2.1 The client

Clients in Churchman's terms are people who have a purpose that they wish to achieve, and a measure of performance for the successful achievement of the purpose. Purpose and measure of performance will be discussed in the following sections. Clients in this study are:

- The author.
- An audience that may benefit from the contents of the study. These are the systems community and health care planners. The study has been written not only with an academic audience in mind, but also planners who may not have knowledge of the

systems approach. The dilemma has been the attempt to strike a balance with these two audiences in mind. The result is that some sections, such as the chapter about Churchman's work, may be too complete. On the other hand, an understanding of Churchman's philosophy is fundamental for understanding the argument. Furthermore, because of the unavailability of his texts, this summary may be of value to other students of the systems approach.

If the study is considered to be of sufficient merit and accepted as such by the community of experts in these disciplines, it will become part of their fact nets. The measure of performance will be if the work in time contributes towards health care planning.

- The institution of learning, in this case the university, may be a beneficiary of the study. Their purpose may be seen as assisting students in acquiring knowledge and experience. The measure of performance is additional prestige to the institution, which in turn may attract more students. This is a positive feedback loop. The loop also attracts funding which adds to the survival of the institution.

1.2.2 The purpose of the study

Purpose has been defined as the ability to select own objectives and the means for attaining them. The following objectives can be identified as the purpose of the study.

- To answer the question: What is wrong in the medical profession, and what can be done about it?
- To learn a new paradigm that:
  a) May be suitable for answering these questions; and
  b) May contribute to an improvement of my own practice of medicine.
- To be awarded a suitable qualification in recognition for the work done, in other words, to gain legitimacy in the systems and health care communities in the traditional sense.
- To make available the findings of the study to designers of health care systems and to the systems community by the publication of the results, and to contribute to health care design in this way.

The means selected for achieving the purpose, has been formal study through a faculty that is recognised as being a leader in the field of systems management.

1.2.3 The designer

This is a person who can change the measure of performance. In this case, the author as client is also the designer of the learning system. He has had the opportunity to design the format of the study in order to attain the purpose as a client. In addition, the supervisor, as representative of the faculty, has contributed to the design of the study through the input of his expertise. The quality of expertise and input therefore contributes to the measure of performance.

1.2.4 The measure of performance

The study has answered the question: What is wrong with health care and what can be done about it? Whether this has been done successfully will be determined by:

i. The academic acceptability of the text, in other words, whether it will be of sufficient merit to be awarded the qualification entered for.

ii. The acceptability of the work to the systems and health care communities, in other words, whether it will contribute towards health care planning.
iii. The amount of personal learning that has taken place. This will be reported on later in the chapter.

Churchman suggested that for a design to be successful, the process that was used should be communicated to others who may benefit from the learning, the methodology of the process should be recorded, the design must include different viewpoints, and the design must be suitable to answer the question. The design will have been successful if the purpose have been achieved and the measures of performance satisfied.

1.2.5 The decision maker

The decision maker is someone with the ability to change the measure of performance of the system. In terms of the learning system, the most important decision makers are the appointed representatives of the faculty, who will decide upon the merit of the work. In this system, the supervisor is both designer and decision maker. This decision is influenced by an environment not under their control, namely the community of experts that they are part of and the learning institution. The community of experts require that the work should be of a format that will ensure agreement and therefore legitimacy. The institution have similar requirements, but based upon different measures.

1.2.6 Guarantee

The designer seeks to ensure that the design will be successful. In terms of purpose, that would entail:

- A guarantee that the study will be academically acceptable.
- A guarantee that the study will contribute towards health care planning.
- A guarantee that the answers to the study are legitimate.

In terms of the pragmatic approach, their can be no guarantee that these goals will be achieved. In this learning system, the ideal of acceptability can only be approached by a sufficiently comprehensive inquiry and sufficient insight gained by learning, in other words if sufficient knowledge and experience have been gained.

2. The process of inquiry

The inquiry for this study took place within the following frameworks:

- It followed a pragmatic approach. The measurement of performance of a pragmatic approach to inquiry is the achievement of a purpose. Investigation starts with the history of the problem and stating the causes often suggest possible solutions. The pragmatic position is that we cannot start with certain knowledge, therefore we have to use the available knowledge even though it is imperfect. To reduce the risk of making an error, inquiry ought to be comprehensive and should include as much available knowledge as possible. Furthermore, we have to be prepared to adjust our findings if further knowledge becomes available, therefore the process of inquiry is never final. Comprehensiveness may be achieved by using an approach that takes a broad view, such as the systems approach, and the process of inquiry may be continued by a learning system. Kolb's learning cycle is both pragmatic and comprehensive and was used as the basic framework for the text.

- It followed a systems approach. By definition, the systems approach takes a broad view, includes different viewpoints, and concentrates on process. This was the operative paradigm for this study.

- It followed C West Churchman's general systems theory and methodology. Churchman's philosophy is founded upon the principle of comprehensiveness. Only by achieving the pragmatic aim of including all viewpoints may we reduce the risk of error in measurement and decision making. The implication of this is a broad view and therefore a systems approach. Decisions are made based upon the knowledge gained from inquiry. Knowledge in turn enables action to take place. Churchman's interest was in the way we inquire and make decisions. In human systems, decisions are often made based upon the world view of the decision maker and designer, therefore, inquiry tests the knowledge upon which these images are based.

  Images (also called mental models or beliefs) are the result of knowledge and experience. They serve as a reference for future action. The interpretation of knowledge and experience is often inaccurate, which leads to inaccurate beliefs. Furthermore, the accurate transmission of images to other individuals is extremely difficult. Images can be shared by groups of individuals, and are the problems of their creation and transmission are the same. The testing of how images were formed (the assumptions upon which they are based) and interpreted, is an important method for making them more accurate and for learning to take place.

  Churchman designed a system for testing the ways that we acquire knowledge. These are:

  i. Facts nets. Contingent truths are determined and these are linked together in fact nets. The validity of fact nets are determined by the accuracy of contingent truths.
  ii. Agreement. The validity of knowledge is often determined by agreement amongst a community of experts. However, this is no guarantee that the information is correct.
  iii. Speculation. Knowledge is based on premises. The validity of knowledge can be tested by questioning the premises upon which it is based. The validity of premises cannot be guaranteed.
  iv. Dialectic. The use of the same knowledge can lead to different world views. Different world views can be synthesised into a more comprehensive representation of reality by a dialectic process. In empirical matters, experts are in possession of the necessary knowledge for decision making, but in matters of values, there are no experts. Therefore, to be comprehensive, the views of both experts and those affected by decisions ought to be included in a dialectic synthesis. This concept of comprehensiveness is fundamental to a systems approach.
  v. Progress. All problems of science are interrelated and the measure of progress towards betterment is a value problem. No decision can be objective if it is value free.

  None of these methods individually can guarantee accuracy, but applied as a system for inquiry into knowledge, it can improve learning and therefore contribute towards the ideal of absolute truth. In other words, it is a method for achieving the pragmatic aim of approaching the ideal of valid truth indefinitely.

  For inquiry into human systems, Churchman designed a framework to identify relevant components that interact with each other. These are:

i. Clients who have a number of possible futures. For achieving preferred ends, they have purposes that are goals, objectives or ideals. There is a measure of performance by which they judge whether the purpose have been achieved satisfactorily.
ii. Decision makers control the means that clients need to achieve their ends. They belong to other systems that affect their ability to make decisions and which they cannot control. (This is a feature of complex systems).
iii. There are designers who assist decision makers in finding positions compatible with that of their clients.

To achieve comprehensiveness of inquiry, Churchman suggests that that the following ought to be part of the decision making process:

i. The history of the problem is part of the solution.
ii. A system for inquiring into and verifying the accuracy of knowledge.
iii. A system for structured inquiry into human systems.
iv. The values of those affected by decision making ought to be part of inquiry. In other words, decision making is approached in terms of what could be, as well as what ought to be.
v. Rational decision making ought to consider the "enemies" or irrational ways that decisions are made as a dialectic alternative.

In the application of this approach, there are important additional considerations. The boundary selected for the inquiry is an arbitrary decision made by the designer. This assists in inquiry but does not represent reality. If the purpose of the design cannot be achieved, the boundary within which inquiry takes place ought to be increased.

The designer has two critical problems, namely the ways that planning will be implemented, and a guarantee than planning will lead to betterment. The former is resolved by including clients, who will have to implement planning, as participants in planning. They represent the value aspect in the dialectic argument between knowledge and values. However, the pragmatic position holds that the perfect decision cannot be attained, and there can therefore be no guarantee that a plan will not have an adverse effect. This realisation ought to be included in the decision.

Finally, Churchman approaches planning by way of a pragmatic ideal. Therefore, the aim of the plan ought to be the achievement of an ideal. This may never be possible, be the ideal can be approached indefinitely. This means that planning is not meant to be a short-term venture and that it will inevitably affect future generations. The planner therefore has a responsibility not to plan in such a way that future generations will be worse off.

In retrospect, the learning experienced in this study was influenced largely by the personal insight gained from Churchman's work. It started off as an empirical process during which information was gathered about the systems approach in general and health care systems in particular. As the volume of learning increased, it became necessary to order the information into fact nets. To do so, it became vital to have an approach as foundation, which would be useful for adding knowledge to in the future. Furthermore, questions about the validity and source of expertise of some of the knowledge arose. As my understanding of Churchman's work increased, I realised its importance as privileged knowledge that would form the basis for the growth of my own fact nets about systems thinking. Personally, in this respect the future value of the work done in chapter 5 is immeasurable. Churchman's work has taught that there is no guarantee for its accuracy as privileged information, but it is my submission, as a result of this study, that his is the

most comprehensive systems philosophy available at present for this purpose. But the power of his work is that his methodology for inquiry would still be of use, even if a different paradigm should replace his philosophy. It is the same inquiring system that was used for validating the knowledge built into the fact net as it exists now.

The reading of Churchman's work went through three cycles of learning, and with every cycle, learning, knowledge and insight, increased. Similarly, the text of this study went through more than one revision. The additional learning and insight gained from every revision was more than the refinement of the text itself. Even now, there is a feeling that this text will still be incomplete when it is submitted for examination, because learning is still taking place. However, goal fulfilment requires submission by a required date. The value of the inquiry is that the process of learning will carry on long after the study was completed. Therefore, irrespective of the outcome of examination, the objective of teaching a long-term approach to learning and inquiry by the supervisor as planner, has been successful.

Churchman's approach has become part of my thinking about problems, decisions and life in general. It has taught me to be rigorous in argument and critical of assumptions. More importantly, it has taught the importance of observing situations in terms of the larger whole of which it is part. The solution to questions of complexity is to sweep in more knowledge to increase the scope of thinking, rather than reduce it to its parts. In conclusion, Churchman's systems approach has become part of my weltanschauung, not as a rigid formula, but as a powerful approach to an ideal of lifelong learning.

3. Experience

Experience in this study has taken place on two levels, in terms of the health care system studied, and on a personal level.

3.1 A SYSTEMS APPROACH TO HEALTH CARE

When a systems approach is applied to medicine, some generalisations can be deduced. The approach to medical diagnosis and treatment lends itself to pragmatism. It is by definition purposeful and has a measure of performance (see chapter 6). Furthermore, clients, designers and decision makers, can be identified in terms of a Churchmanian approach. The traditional diagnostic process is a linear sequence of events, but this study has shown that it would be more efficient as a cyclical process. Diagnoses and the decision to treat is made upon incomplete knowledge and a system whereby review can take place and adjustments made if necessary, would be imminently suitable to this profession. Furthermore, such a cycle of inquiry may lead to increased knowledge and experience and therefore improved learning.

The health care system in this study has been identified as a complex social system. This means that numerous individuals and sub-systems interact as co-producers to produce products such as treatment. The deterministic belief that physicians are in charge and can control these processes has no meaning in this system. Instead, the purposeful alignment of patients, physicians, and other components of the health care system may be a more efficient way to improve health care.

This by implication means that group learning ought to take place. This may be achieved by an inquiry into the beliefs of members of the system and an important belief identified in this study has been the world view of illness and health care. The current world view is based upon an assumption of illness as simple causal chains and treatment as intervention in these chains. In this study, a systems model of health care is proposed that identifies the health care

system as a complex social system with multiple interactions. This model is based upon an observation of illness in society as a whole and may therefore be more appropriate as a paradigm for health care. Furthermore, this model invites intervention in terms of complex systems and in this study appears to provide a suitable vessel for improvement.

The patient-physician system was identified as a purposeful system with the purpose of decision making. This interaction is usually conceived as a simple one, but a systems inquiry shows this not to be so. Both patients and physicians are clients of the system, although this is usually not explicit in the interaction. Underlying goals therefore often interferes with decision making. In the traditional system, physician are considered to be the decision makers and planners of treatment. However, this implies an assumption of control and an observer apart from the social laboratory. In order to make value rich decisions, the wishes of patients ought to be included in the decision to treat. This would contribute to more complete knowledge and therefore better decision making.

Medical knowledge suffers from the same disadvantages of other sciences. In this profession, knowledge is often considered to be irrefutably true because it has been published in peer accepted publications. This assumption influences research and therefore the growth of paradigms. Errors in medical decision making may have serious consequences. To improve the accuracy, not only should there not be a poverty of information, but the accuracy of knowledge ought to be tested. Churchman's inquiring system is particularly suitable to test this knowledge and can contribute to improved decision making.

The use of systems dynamics models for understanding difficult medical problems, may contribute to a better understanding of illness, treatment and process. In this study, the true depth of the mess in health care only became meaningful when observed in terms of the whole of which the problems are part. This made it possible to identify the structure and function of the different parts and hence to identify possible areas where change may benefit the system as a whole.

The principles identified above were used in this study, in combination with Churchman's approach to inquiry and methodology, to inquire into the current belief system of illness and health care. The result has been a systems view of health care. This view is based upon a model of the prevalence of illness and health in the community, in other words, it takes a broad view. According to the model, the health care system does not deal with illness in totality, but only those aspects of illness that the community can no longer deal with by itself. The implication is that 75% of illnesses are in the community, and therefore the responsibility of primary health care structures, preventative health structures, alternative health care, and self care. Once the community loses the ability to deal with the ill by itself, they become part of the health care system. The result of such a model is that the purpose of specialists is in terms of hospital care and family practitioners become specialists in bridging care between hospitals and the community. The result of this is that the interaction between physicians is altered into a physician network, which is a complex social system. For such a network to act purposefully, it has to be able to:

- Recognise its altered structure in terms of physician purpose.
- Disseminate knowledge between physicians.
- Communicate purposefully.
- Interact purposefully, in other words, should be able to show group learning.

The result of such a system may be a more effective and efficient health care system. Furthermore, the systems view of health care may lead to an altered world view of illness, health care, and professionals, the result being a change in the perception of needs and wants

that both patients and physicians have. This may have a powerful influence on the health care system as a whole. An inquiry into the systems view of health care, using Churchman's methodology, suggests that:

- Both patients and physicians ought to be the clients of the health care system. Patients have ends and physicians are the means for satisfying the ends by using additional means (hospitals, pharmaceuticals, etc.) for doing so.
- The participation of patients and physicians is necessary for health care planning to be implemented. Family practitioner contact and education, and consumer groups may contribute to patient participation. Opinion leader education, the publication of practice profiles, and purposeful remuneration have been shown to be promising methods for ensuring physician participation.
- Governments and business are the institutions with the means for implementing a new world view of health care. They are therefore the decision takers in the system, but are often compromised by underlying power metaphors.
- The medical community has an important responsibility to serve as the source of legitimation in planning. They may be in a position to make a valid contribution towards ensuring the inclusion of values in planning.

Illnesses are highly complex processes and hence it may be more profitable to see physicians as managers of illness. Managers by definition, are people who decide amongst different alternatives. Medicine is not an exact science and there are alternatives to most treatments. Physicians are experts of medical knowledge and they use this expertise when making diagnoses, in other words for deciding amongst alternatives. The application of Churchman's approach may increase their ability to diagnose, by improving the use of appropriately validated knowledge.

During the consultation process, physicians obtain information from patients and then add their expert knowledge to it. The question then becomes: What do I know, and how accurate is the communal knowledge that it is derived from? The implication is that decisions are invariably made upon insufficient knowledge (in the pragmatic sense) and if a satisfactory solution cannot be found to the problem, more knowledge ought to be swept in. This may be achieved by the use of tests, or referral to a colleague, as an additional source of knowledge. Furthermore, incomplete knowledge may lead to errors, and physicians therefore have to reflect upon the outcomes of treatment. Reflection assists in adjusting the hypothesis and ensures that learning takes place. Churchman's methodology therefore is particularly suitable for use as a learning system in the patient-physician interaction. The decision to treat is based upon alternatives selected by the expert. Only patients are able to upon decide upon the value component of these alternatives. The decision to treat therefore ought to include patients as planners. This may assist in patient learning.

The proposed systems model of health care could not be tested by the participation of those whole be affected by its implementation. The implication is that their participation in planning may alter the model significantly. Therefore, the present model cannot guarantee betterment. However, it can contribute towards a dialectical debate and therefore the synthesis of a more inclusive model that may be more suitable.

The study was also accompanied by significant personal learning. The approach described in chapter 6 is now part of my own medical practice and has had a profound impact on my own world view of health care.

3.2 PERSONAL EXPERIENCE

I have learnt to recognise the inherent complexity of the biological and social processes involved in medicine, and have been humbled by the realisation that a belief that I as a physician can control these processes is a fallacy. Patients get better in spite of what we as physicians do. Churchman's methodology has instilled in me an increased awareness of the ethical responsibility for ensuring the betterment of patients' conditions, in other words, for applying the principles of the Hippocratic oath: Do what you can to improve your patient's condition, and if you cannot, ensure that you do no harm.

The values of patients have to be considered when making decisions. I am more aware of my role as planner, as opposed to decision maker and now encourage patients to participate in the deciding upon appropriate treatments for them. As to be expected, this approach is not without problems. Patients and colleagues have belief systems resistant to change and often intolerant of alternative paradigms. Some, however, are keen to participate and I expect them to learn from the interaction and change their world view of illness and health care process.

The practical use of Churchman's approach to decision making has improved my own ability to reason logically. Furthermore, his inquiring system has enabled me to be significantly more critical in validating the empirical knowledge used in medicine and its application in decision making. I now realise:

- The importance of critically testing the assumptions upon which my own images of knowledge are based.
- The importance of challenging the assumptions that shared images are founded upon.
- How resistant such images are to change.
- How such a shared belief in the form of the world view of health care can contribute to an ineffective and inefficiently functioning system.
- The importance of taking a sufficiently broad view of problems. Comprehensiveness leads to more alternatives and therefore more flexibility of choice. The true complexity of these factors only become visible when they are included in a systems dynamic model, with multiple causal loops.
- The ways in which medical knowledge, personal knowledge and knowledge in general are conceived and the effects that such knowledge have on the way we act.
- The fact that the use of knowledge sometimes have undesirable effects and that the possibility that these effects may occur have to be included in the decision making process.

In the end, medical practice is pragmatic, in other words, physicians have to make decisions based upon incomplete knowledge. However, an awareness of the poverty of this knowledge increases the awareness of this incompleteness and also creates a willingness to adjust the decision, should it be required. This is the principle of a learning cycle.

The result of this study has been a vision of what health care could be. Hopefully, it will contribute to a better functioning, cost effective health care system, in other words, a social system model of health care in which continuous learning can take place for the benefit of all who participate in the system.

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